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1590-01

SECTION 1

INTRODUCTION

THE R7912 TRANSIENT DIGITIZER

The R7912 Transient Digitizer is a high-speed signal acquisition instrument capable of operating in either an analog or a digital mode. Acquired waveforms up to 500 MHz (1 GHz direct access) are converted to a speed and format more suitable for viewing on a standard video monitor (such as the Tektronix 630/650-Series). Optionally, the R7912 can convert the acquired waveform to digital form and store the information in a local semiconductor memory (option 14). In this Digital mode, the R7912 operates as an analog-to-digital converter with an effective clock rate of about 100 GHz. The digital waveform data can be transferred through Tektronix interfaces to a variety of devices, including computers, storage display monitors, and data logging units.

The R7912 gains even more power and versatility when included in a Tektronix 2000-Series Waveform Processing Package. The WP2000-Series packages are specifically designed with the characteristics of the R7912 in mind. The various packages provide capabilities ranging from simple viewing-only systems (e.g., WP2000) to computer-based, multiple waveform processing systems including Tektronix designed software (WP2321). Other WP packages allow the R7912 to be added to existing systems using the CAMAC interface standard.

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CONTROLS AND CONNECTORS

General

The major controls and connectors for operation of the R7912 are located on the front panel. Output and interface connectors and several auxiliary controls are located on the rear panel. To make full use of the capabilities of the R7912, the operator should be familiar with the function of each of these controls and connectors. A brief description of each is given here. More detailed operating information is given in Section 2, Operating the R7912. Refer to Figs. 1-1 and 1-2 for control and connector locations.

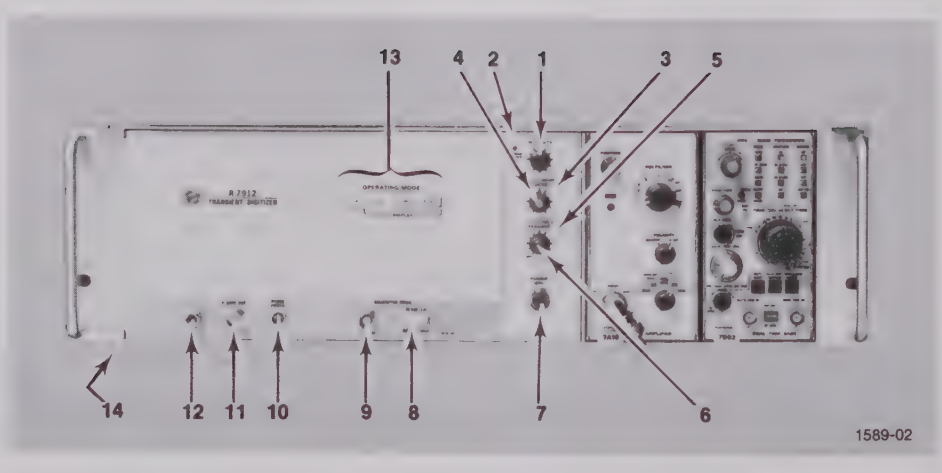


Fig. 1-1. R7912 front panel.

FRONT PANEL

1. INTENSITY	Three-turn control permits adjustment of writing-beam current to optimize trace contrast and definition.
2. DECREASE INTENSITY light	Blinks to indicate that the INTENSITY, READOUT, and/or GRATICULE (if so equipped) settings are too high. When this condition occurs, the trace is deflected off screen and will remain there until the intensity level(s) has been reduced to a safe operating level.
3. FOCUS	Provides adjustment for best display definition.
4. BEAMFINDER (Concentric with FOCUS)	Compresses the display into the viewing area. This function is not operative if DECREASE INTENSITY light is blinking.
5. READOUT	Adjusts the intensity of the alphanumeric character readout. In the OFF position, both the character readout and the electronic graticule (if so equipped) are turned off.
6. GRATICULE (Concentric with READOUT)	Adjusts the intensity of the electronic graticule.
7. POWER	Controls power to the instrument.

8. CALIBRATOR Switch	IN: The inward position of the CALIBRATOR switch selects a 4.0-volt peak-to-peak calibrator signal or a 0.4-volt peak-to-peak signal into 50 Ω. OUT: The outward or released position of the CALIBRATOR switch selects a 0.4-volt peak-to-peak amplitude calibrator signal or a 40-mV peak-to-peak signal into 50 Ω.
9. CALIBRATOR Connector	BNC connector provides access to the calibrator signal. Normal repetition rate for the calibrator is one megahertz. It can be changed (internally) to one kilohertz, if desired.
10. PROBE POWER	Four-pin connector provides a power source for active probes.
11. +GATE OUT	BNC connector provides a positive-going signal coincident with the writing-beam sweep.
12. Ground Connector (not labeled)	Provides a means for connecting external equipment to the R7912 chassis ground.
13. OPERATING MODE Switches	DIGITAL: When the button is illuminated, whether depressed (Local operation) or not depressed (Remote operation), the R7912 is operating in Digital mode.

NON STORE: In this mode, the R7912 converts the acquired signal into a TV-compatible format. To operate in this mode, the button must be depressed and the light must be on.

STORE: Places a 603 Storage Monitor into the Storage mode when the monitor is connected via the rear-panel D or P connector.

ERASE: Erases a 603 Storage Monitor each time the button is depressed when the monitor is connected via the rear-panel D or P connector.

14. CONTROL ILLUM (Slide switch located on left side of instrument) — Selects brightness of plug-in pushbutton indicators.

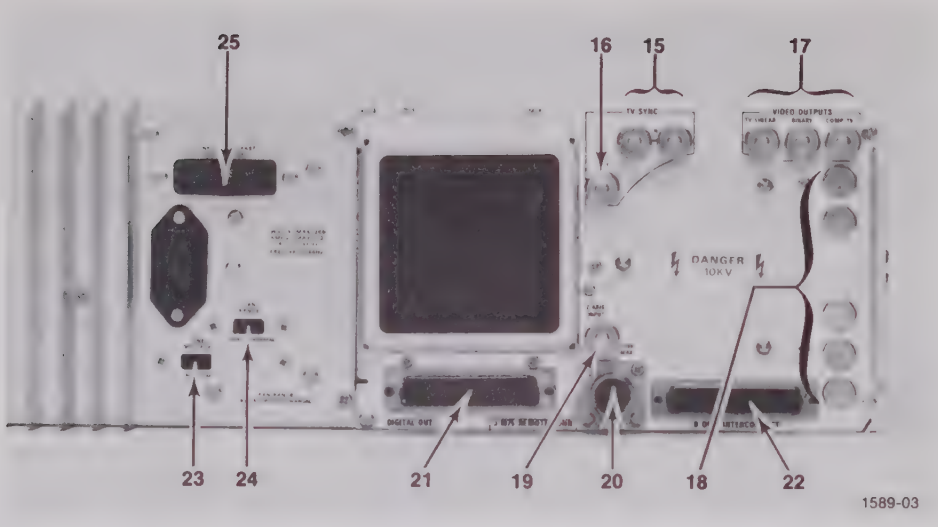


Fig. 1-2. R7912 rear panel.

REAR PANEL

15. TV SYNC IN

BNC connectors allow the reading section of the R7912 to be synchronized with other TV equipment when the R7912 is in the TV mode.

16. TV SYNC OUT

BNC connector provides an EIA standard sync waveform to synchronize external equipment with the R7912.

17. VIDEO OUTPUTS

These connectors provide a positive-going signal whenever the reading gun crosses a written trace.

TV LINEAR: This signal is a replica of the intensity of the acquired waveform.

BINARY: A two-level video signal derived from the linear video signal.

COMP TV: Binary video with sync added.

18. Spare Connectors	There are five optional BNC connectors for special purposes.
19. Z-AXIS INPUT	BNC connector allows external Z-Axis modulation of written waveform. Full modulation is achieved with a 2-volt peak-to-peak signal.
20. J-1075 REMOVE CONN	Nine-pin connector to provide remote single-sweep reset and ready indication for the time-base unit in the right compartment as well as single-shot readout operation.
21. DIGITAL OUT	104-pin connector provides digital output signals and control lines for operating the R7912 in Digital mode. Refer to the Specification section of this manual for a complete list of pins and their functions.
22. D or P INTER-CONNECT	50-pin connector that provides power and signals to a suitable Tektronix instrument in the P or D series.
23. LINE VOLTAGE	Slide switch selects the nominal operating voltage (115 or 230 volts)
24. FAN RANGE	Slide switch selects proper fan operating voltage.
25. LINE FUSE	This assembly contains the line input fuse.

INSTRUMENT OPTIONS

The options listed below are described in detail in Section 2, Operating the R7912. Service information for these options is located in Section 3 of this manual.

Option 1 deletes the Tektronix alphanumeric readout.

Option 5 changes the power line frequency range to 360-440 hertz.

Option 13 changes the TV format to 625 lines with a 50 hertz field rate.

Option 14 adds the internal Digital Memory having a capacity of 4096 ten-bit words.

Option 20 replaces the standard Tektronix alphanumeric readout system with one producing an ASCII character subset.

PLUG-IN UNITS

General

The R7912 is designed to accept two Tektronix 7000-series plug-in units. This plug-in feature allows selection of bandwidth, sensitivity, display mode, etc. to meet specific measurement requirements. The measurement capabilities of the resultant system are in large part determined by the characteristics of the plug-ins used.

Installation

To install a plug-in unit into one of the plug-in compartments, align the upper and lower rails of the plug-in with the associated guide rails in the compartment and fully insert it into place. To remove a plug-in, pull the release latch on the plug-in unit and pull it out of the compartment.

When the R7912 is calibrated in accordance with the calibration procedure given in this manual, the vertical and horizontal gains are standardized. This allows calibrated plug-in units to be changed from one instrument to another without recalibration. However, the basic calibration of the individual plug-in should be checked when installed in the system to verify measurement accuracy. See the operating instructions section of the plug-in manual for verification procedures.

POWER AND SAFETY INFORMATION

AC Power Sources

The R7912 Transient Digitizer is designed for operation from a single-phase earth referenced power source having one current carrying conductor (the neutral conductor) at or near earth potential. Operation from a power source with both conductors live with respect to earth (such as phase-ti-phase on a three-wire system) is not recommended. Only the line conductor has over-current (fuse) protection within the instrument.

Power Cord

The standard R7912 is equipped with a three-conductor power cord terminating in a three-terminal polarized plug for connection to the power source and to safety-earth. The safety-earth terminal of the plug is directly connected to the instrument frame. For protection from electric shock, insert this plug only in a mating outlet with a safety-earth connection, or otherwise connect the frame to a safety-earth system.

The power cord on the R7912 may conform to either of two electrical codes as described in Table 1-1.

TABLE 1-1

Conductor	USA (NEC) & Canada	IEC
Line	Black	Brown
Neutral	White	Light Blue*
Safety-Earth	Green w/yellow stripe	Green w/yellow stripe

*Tinned copper conductor.

Operating Voltage

The R7912 can be operated from either a 115-volt or 230-volt nominal line voltage source. A line voltage switch on the R7912 rear panel allows selection of either voltage. To change the setting of the line voltage switch, insert a screwdriver or similar tool into the switch slot and set it to the desired range. Table 1-2 lists the range of acceptable power supply voltages for each switch position.

TABLE 1-2

Regulating Ranges for Line Selector Switch

Line Selector Switch Position	Regulating Range (Volts AC)
115	90-132
230	180-264

CAUTION

The R7912 can be damaged if the line voltage selectors are not set for the correct supply voltage range.

The R7912 cooling fan requires separate voltage selection. The FAN switch, located on the rear panel (see Fig. 1-3), and a multi-pin harmonica connector located near the power supply assembly (see Fig. 1-4) are used to select the proper fan operating voltage. Table 1-3 details the various switch and connector combinations required for different supply ranges. The R7912 is shipped from the factory with the harmonica connector in the A position unless specified otherwise.

TABLE 1-3

Fan Operating Voltage

Nominal Line Voltage	Line Voltage Range	Fan Switch Setting	Multi-pin Connector Position
115	108-132	NORM	A or B
	90-110	LOW	A or B
230	216-264	NORM	A or B
	198-242	LOW	A
	180-220	LOW	B

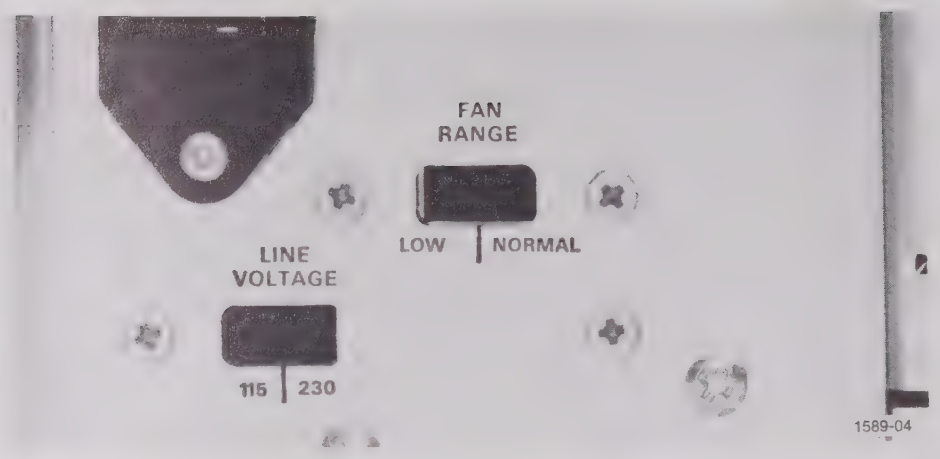


Fig. 1-3. Fan Range switch.

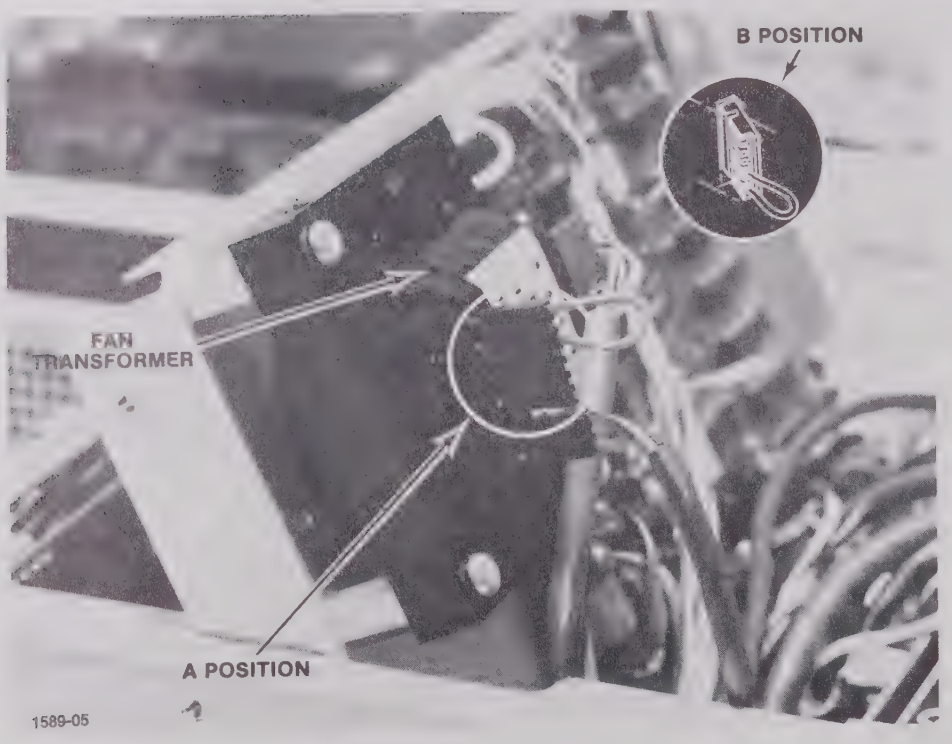


Fig. 1-4. Fan range selection.

Operating Frequency

The standard R7912 is designed to operate from a power source providing alternating current at 50 to 60 Hz. Instruments equipped with Option 5 have been modified to operate at 360 to 440 Hz. The principle modification for Option 5 concerns the cooling fan motor. Attempting to operate the R7912 at an incorrect line frequency may result in damage to the fan motor and associated components.

Operating Temperature

The R7912 can be operated where the ambient air temperature is between 0 degrees C and +40 degrees C. Writing rate, however, must be derated when the ambient temperature is below +10 degrees C; refer to the CRT Writing Rate specifications in the Specification section of this manual. The R7912 can be stored at ambient temperatures between -55 degrees C and +75 degrees C. After storage at temperatures beyond the operating limits, allow sufficient time for the instrument to stabilize within the operating limits before applying power.

A thermal cutout in the R7912 provides thermal protection and disconnects power from the instrument if its internal temperature exceeds a safe operating level. Power is automatically restored when the temperature returns to a safe level. Operation of the instrument in confined areas or in close proximity to heat-producing devices may cause the thermal cutout to open.

The R7912 is cooled by air drawn in through the air filter on the rear panel and blown out through the holes on the top and sides of the instrument. Adequate clearance must be provided at these locations for air circulation.

Safety Information

The R7912 Transient Digitizer has been designed and tested in accordance with the International Ectrotechnical Commission publication 348 "Safety Requirements for Electronic Measuring Apparatus" and meets the requirements of Safety Class 1 apparatus.

This instruction manual contains some informative and warning text which the user must follow to ensure safe operation and to maintain the instrument in safe condition.

SECTION 2

OPERATING THE R7912

INITIAL ADJUSTMENTS

After all cabling has been completed and checked, install the vertical amplifier plug-in (7A-series) in the left compartment and the horizontal plug-in (7B-series) in the right compartment. Set the horizontal for a free running trace (AUTO trigger mode) at one microsecond/division. Set the vertical for a centered trace (POSITION control at midrange) at one volt/division sensitivity (or 100 millivolts/division if the plug-in has a 50 ohm input). Set the input coupling switch to DC. Connect a BNC coaxial cable from the CALIBRATOR connector to the input of the vertical amplifier. Latch the calibrator switch IN (4.0 volts).

If a video monitor or 605 Storage Monitor is connected to the R7912, set its brightness and contrast to normal viewing levels.

Press the NON-STORE button on the R7912 front panel.

Turn the READOUT knob (outer portion) fully counter-clockwise until it clicks OFF.

Turn the GRATICULE knob (inner portion) fully counterclockwise (OFF).

Turn the INTENSITY knob fully counterclockwise (OFF).

Switch the R7912 and its peripherals ON. Allow 20 minutes warmup time before using the instrument. After power is applied, check to see that the cooling fan is running and that the front panel push-button lights come on (only the depressed button should light). If the fan does not run, check power connections.

OPERATION

Locating the Trace

Slowly rotate the INTENSITY control clockwise until a trace appears on the monitor. Watch the DECREASE INTENSITY light as you increase intensity.

CAUTION

The writing beam intensity is critical. Excessively high settings of the front panel INTENSITY control can permanently damage the diode target. Special circuitry within the R7912 protects the target from gross misadjustment of the INTENSITY control, but operation at or near the automatic protect level can cause target damage.

The trace should appear on the TV monitor within one-half to one turn of the INTENSITY knob. If the trace does not appear, or if the DECREASE INTENSITY light begins to blink, decrease the intensity and recheck the trace position controls on the plug-ins. Make certain that the video monitor is properly connected and adjusted. Again advance the INTENSITY control. If the display still doesn't appear, press the BEAMFINDER button.

The Beamfinder compresses an overscanned display to within the viewed target area. It will not operate if the DECREASE INTENSITY light is blinking. While holding the BEAMFINDER switch depressed, adjust the plug-in position controls for a display near the monitor centerline. Release the switch. The display should now be visible on the monitor.

Adjust the INTENSITY control for a well defined trace image on the monitor. Do not set the intensity so high that the waveform swells (blooms) over its slowly changing portions.

Adjust the FOCUS control for best trace definition.

Alphanumeric Readout

If your R7912 is equipped with the standard Tektronix alphanumeric readout (does not have Option 1 or Option 20), the plug-in knob settings can be displayed on the monitor screen. The outer part of the concentric READOUT/GRATICULE knob on the R7912 front panel controls the intensity of the display. Turn the outer portion of the knob clockwise from the OFF position. The alphanumeric display should begin to appear at the upper left and lower right of the monitor screen. Figure 2-1 shows a typical alphanumeric display on a Tektronix 632 monitor. The characters displayed indicate the current settings of the plug-in scale-factor controls. Vertical scale-factor information appears at the left edge of the screen with channel 1 of a dual-channel plug-in at the top and channel 2 at the bottom. Similarly, the horizontal scale-factor information appears at the right of the display, with the main sweep at the top, and delayed sweep (if a dual time-base is installed) at the bottom.

Some special characters are provided by the readout logic to indicate unusual plug-in settings. For example, operating a plug-in in the variable or uncalibrated mode adds a " > " to the display. Setting a vertical amplifier plug-in to invert the incoming signal adds a "↓". Complete information concerning the characters produced by each plug-in can be found in the respective plug-in manual.

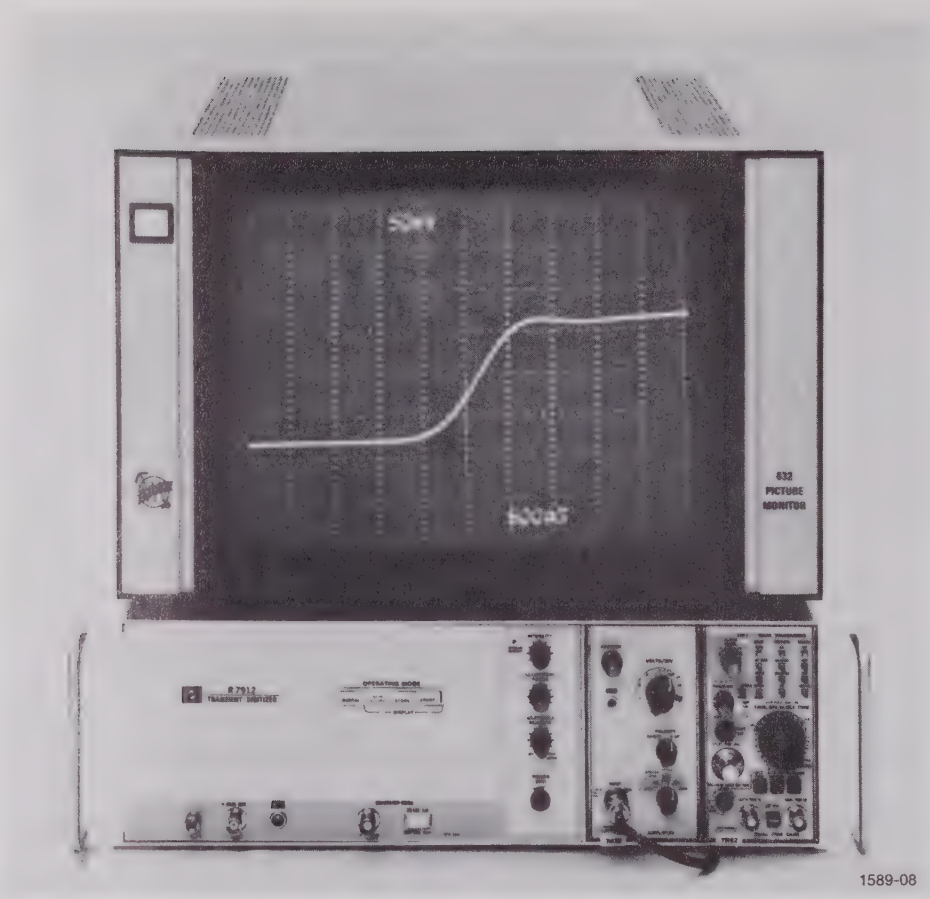


Fig. 2-1. A typical video monitor display.

The READOUT control should be turned OFF when operating the R7912 in Digital mode. In this mode, all information written on the target is converted to digital form and stored in local memory. Since the alphanumeric readout is written on the target with the waveform, it would be digitized as well. This adds unrelated data to the stored waveform, making processing very difficult.

ASCII Readout

The ASCII Readout system (Option 20) replaces the alphanumeric system just described. This option converts the alphanumeric characters normally displayed to their ASCII equivalents and makes them available at the 104-pin DIGITAL OUT connector. No video or storage display of the readout characters is available unless provided by an external controller capable of using the ASCII data.

Electronic Graticule

The Electronic Dot Graticule adds a highly stable array of dots to the video monitor display. This dot array functions as a stable frame of reference for visual measurement of waveforms. The inner part of the concentric READOUT/GRATICULE knob controls the intensity of the graticule.

CAUTION

The intensity controls for the waveform display, the alphanumeric readout, and the electronic graticule interact. Turning the READOUT control OFF (detent position) will cause the remaining display to increase in intensity. Excessive intensity may trigger the automatic protection circuitry, deflecting the display off screen. To prevent target damage, reduce the INTENSITY control before turning the readout or graticule off.

Note that the Electronic Graticule consists of a matrix of dotted lines (see Fig. 2-1). This operating mode provides a convenient visual aid when operating in Non-Store mode. When operating in Digital mode, however, the dot array is digitized along with the acquired waveform. An average waveform requires only about 1,600 words of memory space, while the full Electronic Graticule array may require several thousand words. Since only 4,096 words are available, memory overflow can occur before the entire waveform is digitized, leaving a gap in the displayed waveform.

To eliminate this problem, the Electronic Graticule was designed to operate in two modes: Full, as just described, and Vertex, where only the dots at major graticule line intersections are generated. The Vertex mode is selected with a strap option on the Graticule Generator circuit board.

Sweep Speed and Intensity

The writing beam intensity required for a visible trace varies directly with the horizontal scale factor setting. Low sweep speeds require relatively low intensity settings, while extremely high sweep speeds may require near maximum intensity.

CAUTION

Reducing sweep speed has the same effect as increasing the writing beam intensity. The front panel INTENSITY control must be turned down (CCW) before sweep speed is reduced.

Adjusting the R7912 intensity and sweep speed for waveform viewing in Non-Store mode is straightforward. The R7912 viewing mode operates in an oscilloscope-like manner, and adjustments should be made to suit the measurement situation. Higher than necessary intensity settings should be avoided, however. Blooming on slowly-changing portions of the displayed waveform is a certain indication of excessive intensity.

CONNECTING THE INSTRUMENTS

Introduction

The R7912 can be used in a variety of test and measurement configurations. The Tektronix WP2000-Series of measurement packages provide many useful instrument combinations, each integrated into a convenient measurement system. Since these packages incorporate different instruments for viewing the waveforms or processing acquired data, only general instructions on setting up the R7912 for a given package type are presented here.

The WP2000-Series can be broken up into two basic categories: 1) viewing-only systems that incorporate video monitors and/or storage monitors for direct viewing of the acquired waveforms, and 2) waveform processing systems that provide computer-based data processing capability in addition to direct viewing. Custom installations employing the R7912 are often based on one of the WP-package types discussed here, and the setup procedure for that WP-package type can be used.

Tektronix supplied cable from the R7912 DIGITAL OUT connector to the 1350 MDU DIGITAL IN connector provides the data path.

The 1350 Memory Display Unit (MDU) converts the digitized waveform data to analog drive signals for the X-Y monitor. R7912 memory loading and subsequent data transfer are controlled from the 1350 MDU front-panel pushbuttons. Complete operating instructions for the 1350 can be found in the 1350 Memory Display Unit Instruction manual.

Waveform Processing Packages

The Tektronix waveform processing packages either include a computer/controller or provide for access to one. The R7912 is used to acquire and digitize waveforms for computer storage and processing. Typical packages include video or storage monitors as well as computer related equipment; connection is similar to the viewing-only packages.

Cabling from the R7912 to the remainder of the system usually begins at the 104-pin DIGITAL OUT connector on the rear panel. A special cable is provided with a 37-pin male connector on one end and a small box housing two connectors on the other (see Fig. 2-3). The box contains a 104-pin connector for the R7912, and a 37-pin female connector for extending the cable to another R7912. Figure 2-4 illustrates this "daisy-chain" cabling capability. Most of the

computer-based WP packages allow up to eight R7912s to be chained together in this way. A single computer can control up to four 'chains' of instruments, or 32 total.

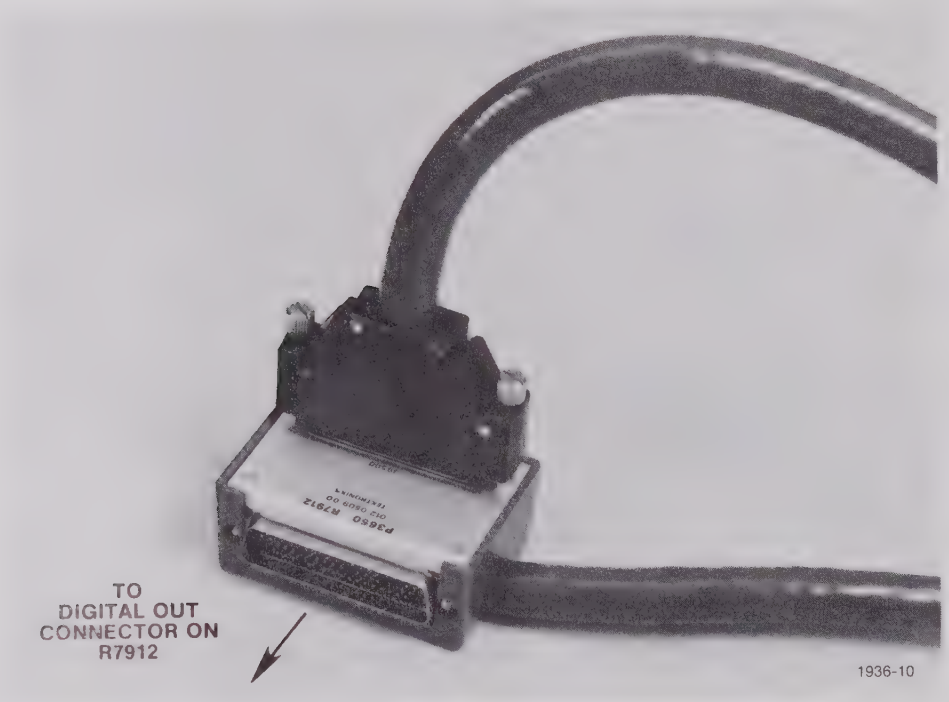


Fig. 2-3. R7912 cable connector.

The 37-pin end of the first R7912 cable connects to a mating connector on a card within the computer/controller. This card provides a control and data signal path from the computer/controller to the daisy-chained R7912s.

Waveform Processing packages that do not include a computer/controller are designed to be added to existing data handling systems. The R7912 is connected to such systems in the same way, through the 104-pin DIGITAL OUT

connector. Various cables are supplied, depending on the package type.

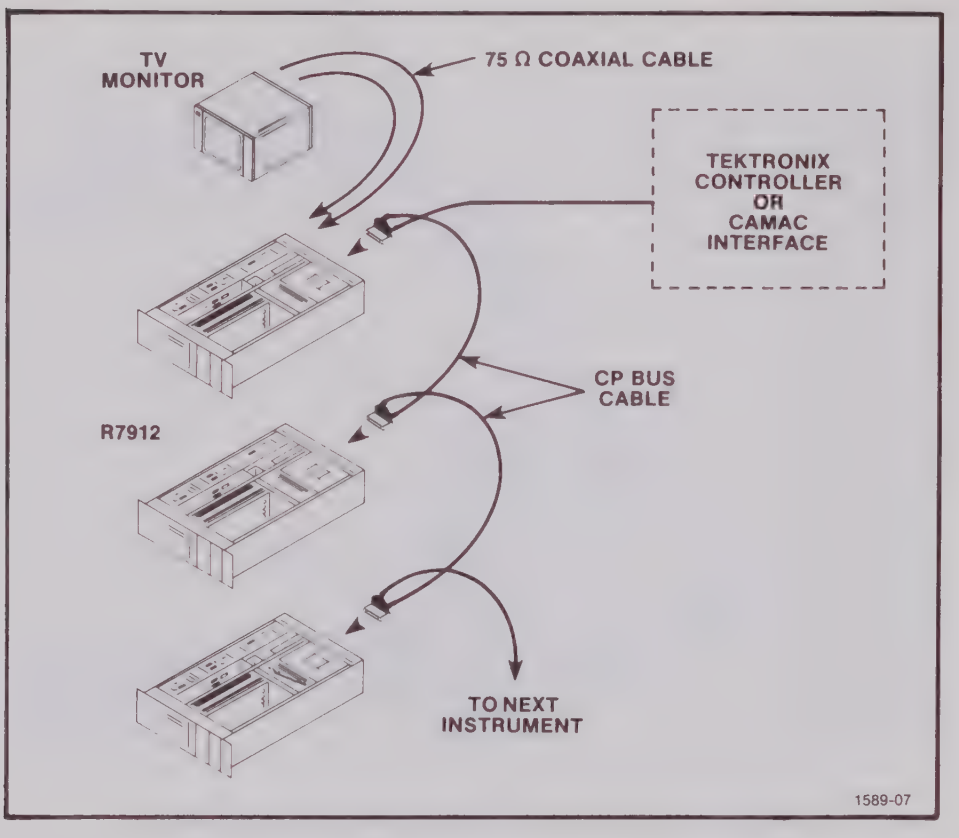


Fig. 2-4. Connecting multiple instruments.

SECTION 3

CIRCUIT DESCRIPTION

THEORY OF OPERATION

Introduction

The R7912 Transient Digitizer allows extremely short rise-time signals to be acquired, converted to digital format, and stored in a local memory. Its operation appears at first to be like that of an oscilloscope, but the similarity is slight. Like an oscilloscope, the R7912 accepts a variety of input signals through conventional 7000-Series plug-in amplifiers. The signal is used to vertically deflect an electron beam as it is swept horizontally under control of the time base plug-in. The similarity ends there.

The Scan Converter

Instead of the usual phosphor-coated CRT found in an oscilloscope, the R7912 uses a specially designed tube called a Scan Converter (see Fig. 3-1). The Scan Converter tube has a small silicon diode target at its center. The electron beam, deflected by the time base plug-in and the amplified input signal (called the writing beam), is swept across this target.

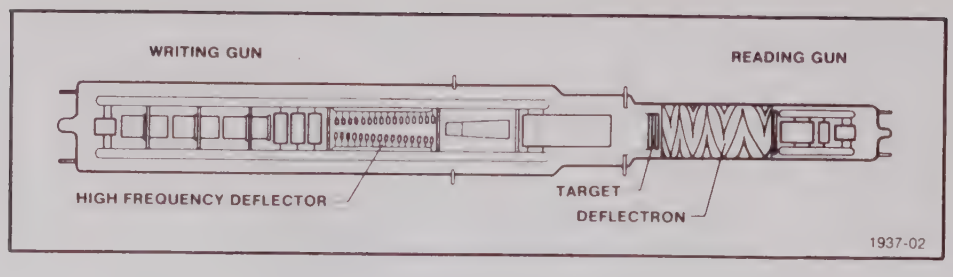


Fig. 3-1. The R7912 Scan Converter tube.

The Target

Composed of an array of silicon diodes on a single chip 1.3 cm by 0.95 cm, the target has a diode density of about 800 diodes per linear centimeter (see Fig. 3-2). These target diodes are formed by diffusing a p-type material into an n-type substrate. The side of the target containing these diffusions faces a reading gun that continuously scans the diode array with an electron beam. This electron beam is referred to as the reading beam, and it deposits a charge on the target surface. The deposited charge causes the target diodes to reverse bias and charge toward the cathode potential of the reading gun. In the charged condition, the target diodes are in an unwritten state.

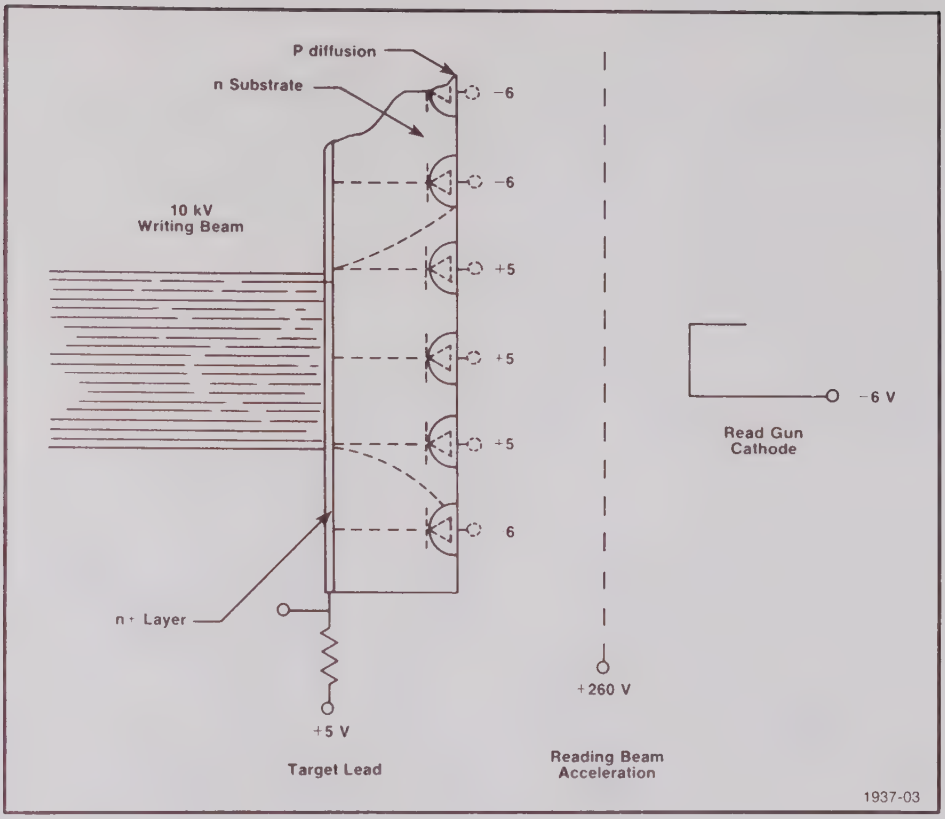


Fig. 3-2. Scan Converter diode target.

Writing a Trace on the Target

The writing beam, carrying the information from the plug-ins, traces an image of the waveform on the back side of the target. Bombardment of the target by the intense writing beam creates electron-hole pairs near the substrate surface. The holes diffuse across the substrate to those diodes opposite the writing beam, causing them to lose their charge. This discharged condition is the written state.

Reading the Target

The reading beam reads the waveform image by recharging the written diodes while it scans the target. Each time the reading beam recharges an area of written diodes, a signal current is generated in the target lead. The operational mode of the R7912 determines what this signal current is used for.

TV Mode

When the R7912 is in the TV mode (NON-STORE), the reading beam scans the target in a horizontal format similar to that used in conventional television systems. The target lead signals obtained while reading in this mode are used to generate video output compatible with television monitors such as the Tektronix 632 Picture Monitor. The TV monitor provides an immediate display of the written trace, and is of great value during initial "setup."

Digital Mode

The Digital mode is of primary importance when operating the R7912 with a computer. In this mode, waveforms are converted to digital information, stored in a self-contained memory, and made available to the computer.

In the Digital mode, the reading beam scans the target vertically. Each vertical scan consists of 512 discrete steps down the target. After each vertical scan is com-

plete, the reading beam retraces to the top of the target and advances one step horizontally. There are 512 horizontal steps across the target (see Fig. 3-3). This scanning technique produces a 512 X 512 matrix of addressable areas on the target.

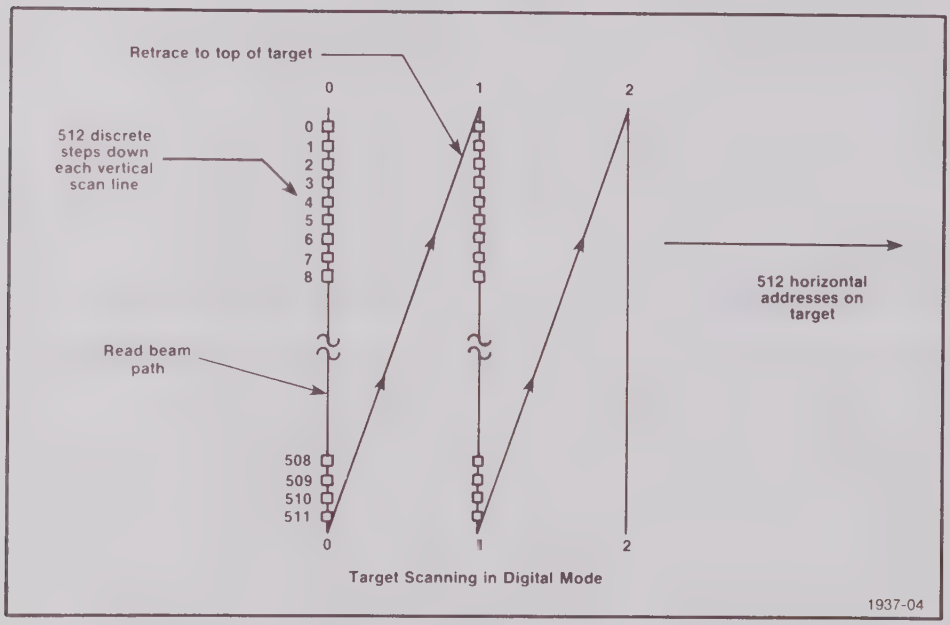


Fig. 3-3. Target scanning in Digital mode.

After each vertical scan is complete, and during the time the reading beam retraces to the top of the target, a binary word is issued by the horizontal address counter. This binary word indicates the horizontal position of the next vertical column to be scanned by the reading beam.

Digitizing the Trace

As the reading beam steps down each vertical column, it pauses at each step for about 100 nanoseconds. The circuitry determines whether or not the diode area under the beam has been written. If the area is unwritten (no target lead signal), the beam steps down to the next addressable area on the target. The step from one unwritten area to the next also takes about 100 nanoseconds.

When the reading beam steps into a written area of the target, the beam recharges the written diodes, producing a target lead signal. The signal causes the reading beam to pause for 1.6 microseconds while a binary word describing its vertical position on the target is issued. The delay allows the vertical word to be stored in the R7912 memory.

Since the writing beam is of finite diameter (approximately 0.02 millimeter), it covers more than one target diode at any given time. Indeed, the target diode density is such that the beam covers several diodes wholly, and several more partially. Writing beam intensity, as controlled by the front-panel INTENSITY control, also affects the number of diodes discharged.

The finite beam diameter results in a trace that may be several vertical addresses wide. As the reading beam steps downward across the discharged trace image, the written diodes are successively recharged and the target

lead signal maintained.

To prevent vertical addresses from being issued at every vertical position throughout the beam thickness, only the rising and falling edges of the target lead signal are detected. A diagram of the reading process is given in Fig. 3-4. Note that the data is issued in the following sequence: horizontal word - vertical word - vertical word; next horizontal word - vertical word - vertical word, etc.

Storing the Data

A sweep trigger begins the memory loading process in the R7912. In Single-Sweep mode, the trigger by itself is sufficient, but in Repetitive-Sweep mode, the trigger must be preceded by a Load Memory command. Figure 3-5 describes a memory load cycle for both sweep modes.

Since the reading beam operates continuously, the point on the target where storing begins is dependent upon sweep speed, waveform repetition rate, and Load Command timing. As a result, the first horizontal address stored may be any of the 512 addresses on the target. The vertical words associated with that horizontal are stored next, followed by the next horizontal word. Reading and storing continues until the first column read is reached again. After all waveform data are stored, the R7912 requests interrupt. Address strap options in each R7912 indicate to the con-

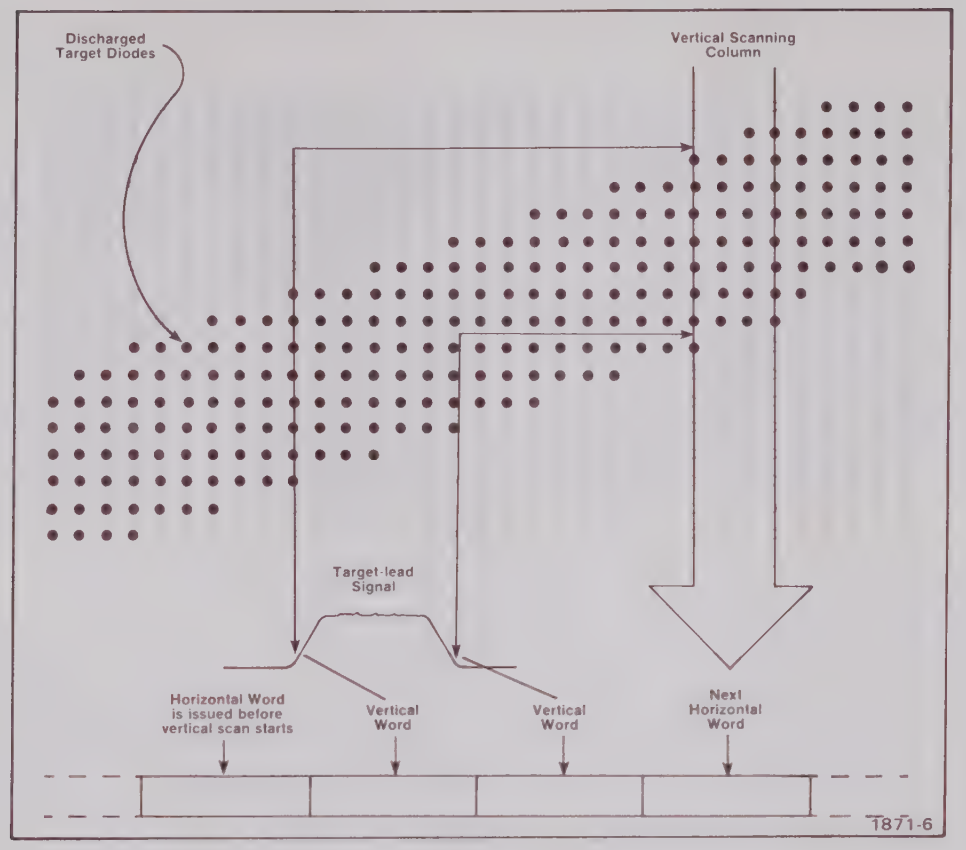


Fig. 3-4. Reading the diode target.

troller which instrument has data, and a service routine can be initiated.

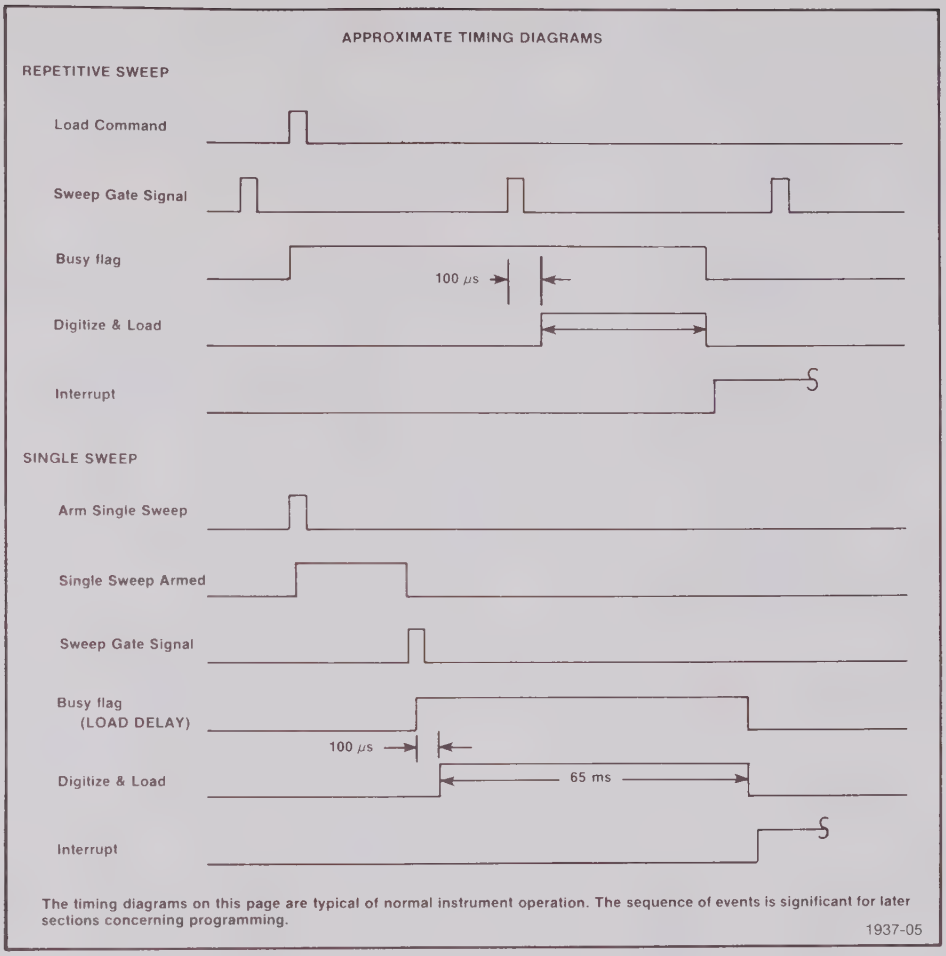


Fig. 3-5. Normal operating sequence.

DETAILED CIRCUIT DESCRIPTION

Main Interface

General

The Main Interface in the R7912 is a circuit board located at the rear of the mainframe plug-in compartment. It carries two edge connectors - one for a horizontal and one for a vertical plug-in, as well as plug-in related circuitry. All communication between instrument and plug-ins occurs via the Main Interface.

Description

Diagram 1 in the Diagrams section describes the Main Interface. Pull the schematic out to its unfolded position so it can be referred to easily. The following circuit description requires frequent use of the diagram. A simplified block diagram is given in fig. 3-6.

Z-Axis Logic. The Z-Axis logic circuitry is represented in the lower right corner of schematic 1. The integrated circuit (U125) is a special device manufactured by Tektronix, Inc. It produces a variable current (0-4 milliamps) at pin 8 to control writing beam intensity through the Z-Axis board (Schematic 18). A variety of input signals regulate the current drive output of U125. Pin 14 accepts sweep gate signals from the horizontal plug-in to regulate blanking during retrace. Pin 9 accepts auxiliary Z-axis signals from

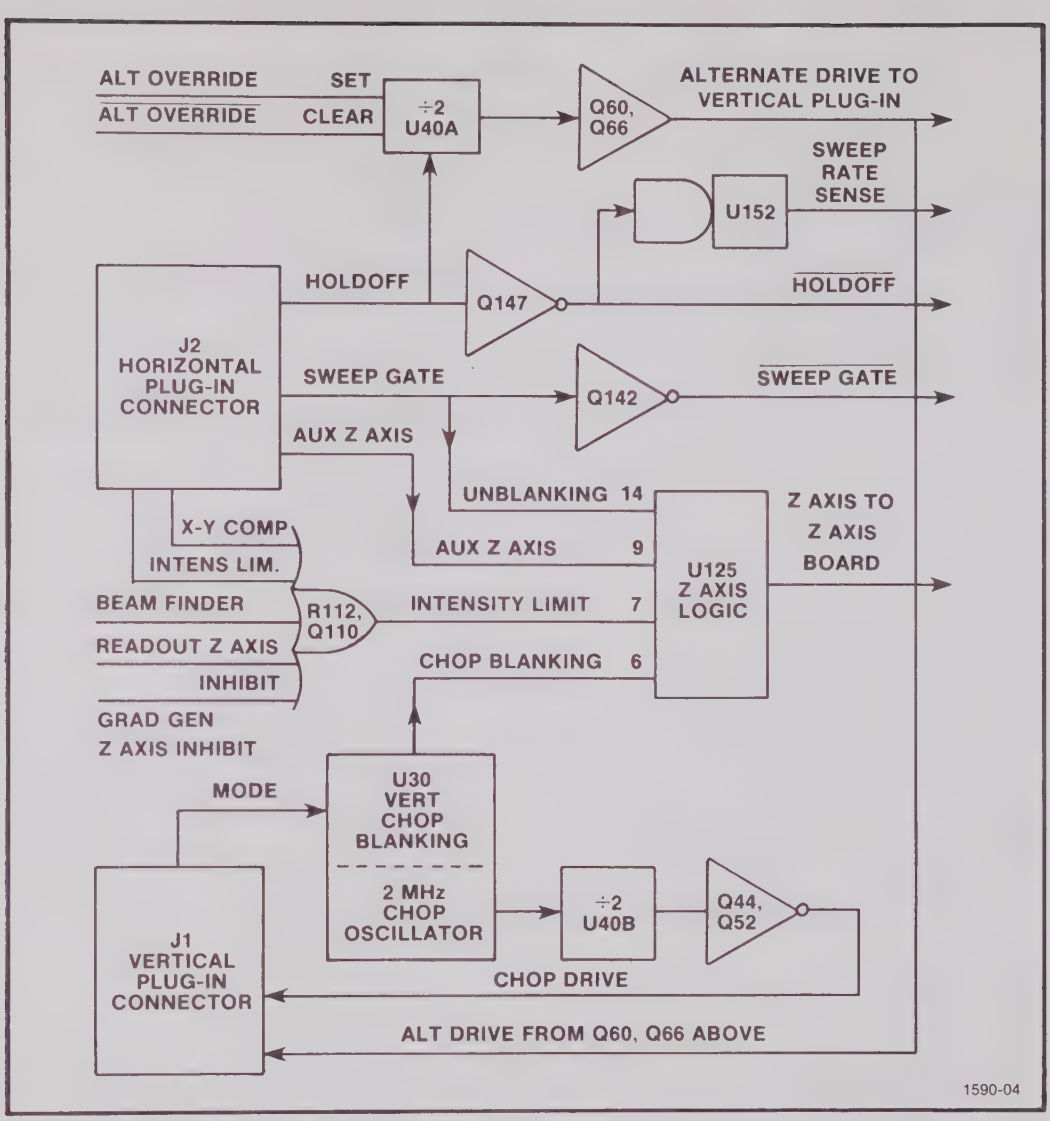


Fig. 3-6. Main Interface block diagram.

either the rear-panel Z-AXIS INPUT connector, or from the plug-ins (e.g., intensified sweep operation with a 7B92A plug-in). Pin 6 accepts 2 Mhz vertical chop blanking signals from U30. Pin 7 limits the maximum beam intensity. Control signals for the pin 7 input come from several sources, including the BEAMFINDER switch, the horizontal plug-in (to reduce intensity at slow sweep speeds or during

X-Y operation), and the Z-axis inhibit lines from the Graticule Generator and Readout circuits. Pin 16 sets overall writing beam intensity from the front-panel INTENSITY control.

Vertical Chop. The vertical chop circuitry is shown in the lower left corner of Schematic 1. U30 is another special integrated circuit made by Tektronix. It includes a clock generator and a chop blanking generator. As previously discussed, the chop blanking signal drives one input of U125. Pin 15 produces a chop clock signal at 2 Mhz when pin 5 is held low. The pin 5 enabling input comes from the vertical plug-in MODE switch when in CHOP mode. U40B divides the signal by two, leaving a 1 Mhz chop signal. Q44 provides a D.C. offset for the emitter follower stage, Q52. The output of Q52 drives the chop circuitry within the vertical plug-in.

Alternate Drive. Alternate mode operation of the vertical plug-in requires a Holdoff signal from the horizontal plug-in. Holdoff comes from pin 4-B of J2 (the right-hand connector on Schematic 1) and is routed to U40A, where a divide-by-two takes place. The 1 output of U40A drives Q66 for level-shifting, and emitter-follower Q60 provides Alternate drive signals for the vertical plug-in. Notice that the preset and clear inputs to U40A come from the Data Interconnect board. These lines (labelled ALT OVERRIDE and $\overline{\text{ALT OVERRIDE}}$) allow an external controller to select

channel 1 or channel 2 of a dual-channel vertical plug-in (if it is set to ALT mode) under program control.

Holdoff. The Holdoff signal is also used (after inversion by Q147) by the Graticule Generator. A rate sense signal produced from $\overline{\text{HOLDOFF}}$ is also provided by U152 for the Graticule Generatr. The Sweep Lockout line immediately above U152 is asserted when the Graticule Generator is writing its dot array on the R7912 target. This prevents interaction between graticule generation and normal trace deflection.

Single Sweep. The Single Sweep Ready line is high when the horizontal plug-in sweep is armed. The Single Sweep Reset line just above allows external control of the sweep. Three external sources are indicated on the schematic.

Trigger Buffer

(SN B09000 and up)

Description

The Trigger Buffer is an isolation amplifier with a gain of one for the vertical trigger signal. This buffer eliminates trigger signal reflections from the horizontal plug-in and isolates the horizontal plug-in from the vertical signal path. The circuit is shown on Schematic 1A in the Diagrams section.

The circuit consists mainly of a special high-frequency integrated circuit, U4500. This IC receives the trigger signal from the vertical plug-in and provides isolation and amplification. The output of U4500 is applied to a differential amplifier formed by Q4551 and Q4555. DC centering of the buffered trigger signal is accomplished with R4563. Overall gain is within 15% of unity.

Calibrator and Front Panel

Calibrator

The calibrator circuit is represented at the top of Schematic 2. Note at the bottom edge that a strap option controlling operating frequency is available. In the 1-Mhz position a crystal-controlled 5-Mhz clock signal from the Sync Generator card is directed through Q203 to the base of Q207. Q207 and Q213 form a free-running 1-Mhz oscillator. The 5-Mhz clock signal synchronizes the oscillator to 1-Mhz $\pm$ 0.1%, but the waveform duty cycle varies somewhat. Selecting the 1-Khz strap option disconnects the 5-Mhz clock signal from Q207 and adds C209 to the oscillator circuit, reducing the free run frequency to approximately 1-Khz.

The oscillator output is coupled through C216 to CR218 and Q221. CR218 is a 10 ma. tunnel diode. The spike waveform from C216 switches CR218 to its high state, turning Q221 on. Notice the emitter bypass circuitry for Q221. C223 and C225 and associated resistors perform the bypass function, while CR225 temperature-compensates Q221.

The square-wave output of Q221 is fed to current-switch Q230 and Q233. The switched current is controlled by R232, and the output voltage is developed across R450. Switching point is determined by the setting of R237. Selecting the 0.4V position of the CALIBRATOR switch adds R245 in parallel with R240, reducing the output voltage to

0.4 volts.

Operating Mode

The front-panel pushbutton circuitry is shown in the center of Schematic 2. The Mode Switch board carries both the switches and lamps for the pushbuttons. Darlington transistors Q250 and Q252 provide lamp drive under control of the pushbuttons, or under external control if the Front-Panel NON-STORE button is pressed.

The external control allows a remote device to switch the operating mode of the R7912 from TV to DIGITAL or the reverse. The external control signal enters at pin 1 of P456 and is tied to the base of Q252. The base is tied high (+5.1 V) by R251 when the NON-STORE button is pressed. A low signal on the $\overline{\text{DIGITAL}}$/DISPLAY line pulls the base low, turning Q252 off. Its collector goes high (through R254) and turns Q250 on. This transistor turns the DIGITAL lamp on (without the button being depressed) and switches the R7912 to Digital Mode. The remainder of the circuitry is straightforward.

+ Gate Out

The + Gate signal available at the R7912 front panel is provided by the circuit shown at the bottom of schematic 2. The sweep gate signal is coupled to the base of Q285, which forms half of a regenerative comparator with Q290. C287 provides regeneration to sharpen the leading edge of the sweep gate pulse. The output of Q290 is coupled through L291 to grounded-base amplifier Q291. The collector of Q291 provides the + Gate signal to the connector. CR296 and CR297 protect that transistor against both positive and negative voltages applied to the connector.

The gate signal is also applied to Q277, providing switch selectable control of the readout circuitry. In the FREE RUN mode, the alphanumeric characters produced by the standard Tektronix readout circuitry are generated on a time shared basis with the input signal. In the GATED mode, the readout is triggered after sweep completion.

Vertical Channel Switch and Amplifier

Channel Switch

The left side of Schematic 3 is dominated by the vertical channel switch IC, U625. This is a special device designed to select one of two pairs of differential inputs with a single control line.

In the R7912, the vertical channel switch selects either the incoming vertical signal from the plug-in, or the vertical ramp signal from the Electronic Graticule Generator. Channel control signals at pin 14 from the Graticule Generator board determine which of the two signals are passed at any time.

Output signals from the vertical channel switch are delayed with a coiled delay line located adjacent to the CRT in the R7912 mainframe. Precise termination of the line is accomplished with selected resistors and capacitors where necessary.

Operating power for U625 is obtained through Q616 and Q617. When vertical information is being passed, the base of Q616 is low, and the voltage divider formed by R613, R615, and CR615 sets pin 3 of the vertical channel switch at about 2.5 volts. When alphanumeric readout is to be generated, a high signal from the Main Interface board turns off the IC at pin 12 and forward biases Q616, reducing the supply voltage.

High Frequency Amplifier

The Amplifier stage, consisting primarily of integrated circuit U685, provides a 50-ohm input impedance (100 ohms differentially) for the Main Vertical Amplifier circuit to permit accurate delay-line termination. The components connecting the input signal to U685 provide forward termination and compensation for the delay line. R658-C658 provide adjustable high-frequency compensation. Connection to the emitters of the input transistors of U685 at pins 5-6 and 11-12 permit the quiescent operating conditions of the stage to be set by discrete components. R682 and R689 set the quiescent operating level; R684 and R688 are selected to accurately set the gain of the differential channels. These emitter inputs also provide a means of injecting the output of the Auxiliary Y-Axis Amplifier. VERTICAL GAIN adjustment R730 and thermistor RT731 set the resistance between the output terminals of U685 to control the current gain of this stage. This adjustment sets the overall gain of the Main Vertical Amplifier circuit; the thermistor provides thermal compensation.

Output Amplifier

The Output Amplifier stage, consisting primarily of integrated circuit U745, provides final amplification for the vertical signal to drive the CRT vertical deflection plates. Terminals to the emitters of the input transistors at pins 1-12 and 6-7 allow the use of discrete components to establish the quiescent operating characteristics of this stage. R741 and R756 are selected to accurately set the gain of the differential channels. R753-R754-R767-R768-R770 set the operating level of this stage. The series RC networks in parallel with R741 and R756 provide frequency compensation for uniform gain at all frequencies within the bandpass of the R7912.

The BEAM FINDER switch, S256, switches the emitter current source for U745 to provide the beam finder function. Normally, the emitter current for U745 is supplied from ground through S256. However, when S256 is actuated, the only emitter current source for U745 is through R771. This limits the dynamic range of the stage by limiting its current, so the display is compressed vertically within the graticule area.

The signal at the output collectors of U745 is connected directly to the vertical deflection plates of the CRT. A distributed deflection plate system is used in the instrument for maximum frequency response and sensitivity. The signal at the output of U745 is connected to the

deflection-plate structure in the CRT and then to termination network LR780-R782A-LR784-R782B. As the signal passes through the deflection-plate structure in the CRT, its velocity is essentially the same as the velocity of the electron beam passing between the vertical deflection plates. This synchronism of the deflection signal and the electron beam reduces the loss in high-frequency sensitivity due to electron-transit time through the deflection-plate structure.

Beam Finder Over-Ride

The Beam Finder Over-Ride stage switches the current source for the Output Amplifier stage to over-ride the beam-finder function as determined by the Vertical OFF Command from the Readout System. Quiescently, the Vertical OFF Command is LO with Q776 conducting to cut off Q773. When the BEAM FINDER switch is actuated, R771 limits the current for the Output Amplifier. When readout information is to be displayed, the Horiz/Vert Inhibit signal goes HI to cut off Q776. The resulting HI on the emitter of Q776 causes Q773 to saturate. The current necessary for full-range operation of U745 is supplied from ground through Q773 during this time.

Horizontal Amplifier

General

The Horizontal Amplifier circuit includes the Horizontal Channel Switch and Main Horizontal Amplifier circuits. The Horizontal Channel Switch portion of the circuit selects the horizontal deflection signal from the output of the horizontal plug-in unit or from the Graticule Generator. The Main Horizontal Amplifier circuit amplifies the push-pull horizontal deflection signal from the Horizontal Channel Switch for application to the horizontal deflection plates of the CRT. This circuit also accepts the signal from the Readout System to produce the horizontal portion of a readout display. A schematic of the circuit is shown on Diagram 4 at the rear of this manual.

Horizontal Channel Switch

The Horizontal Channel Switch determines which input signal provides the horizontal signal to the Main Horizontal Amplifier as controlled by the Graticule Generator circuit. Resistors R821-R823 and R825-R827 establish the 50-ohm input impedance of this stage.

The stage is made up primarily of integrated circuit U825. U825 provides a differential input for the signal from the horizontal plug-in at pins 2 and 15, and the signal from the Graticule Generator at pins 7 and 10. The output at pins 12 and 13 is a differential signal which is

connected to the Main Horizontal Amplifier circuit. The sum of the DC currents at pins 12 and 13 is always equal to the sum of the DC currents at pins 1, 8, 9, and 16 in all modes. This provides a constant DC output current level to the following stage.

The Horiz/Vert Inhibit signal from the Readout System, which is applied to pin 6, has finel control over the output signal from this stage. Quiescently, the signal is LO and the signal from the selected horizontal source can pass to output pins 12 and 13. However, when the Readout System is ready to display readout information, the level at pin 6 goes HI. This level blocks the signal from both horizontal units so there is no signal output from the stage.

Input Amplifier

The signal from the Horizontal Channel Switch is connected to the bases of Q863 and Q873. Stage gain is controlled by the resistor network between the emitters of these transistors, and is adjusted with R872. R868 provides a horizontal centering adjustment by balancing the emitter currents in each transistor. Emitter current is supplied from the +15-volt supply, and from the Z-Axis circuitry.

Notice that two leads from the Z-Axis board connect to the Input Amplifier. In normal operation, the leftmost lead supplies current from the +15-volt supply to the emitters

of Q863 and Q873. The rightmost lead supplies no current. When the BEAMFINDER button is pressed, these two leads switch functions, removing power from the emitters and supplying it to the junction of R878 and R879. Removing the Z-Axis contribution to the emitter current of Q863 and Q873 reduces the dynamic range of the stage. Applying power to the bases of Q887 and Q897 reduces stage gain. The result is a display compressed to within the target area, regardless of the setting of positioning or scale factor controls.

The left and right halves of the remaining amplifier circuits are symmetrical; the top producing the positive-going horizontal ramp, and the bottom producing the negative-going ramp. This description covers the top, or positive, half of the amplifier. The negative half operates in a similar manner.

Driver and Output Amplifiers

The positive-going ramp developed across R860 is directly coupled to the base of Q887. Zener diode VR884 limits the collector swing of Q887 from near ground to +5 volts, preventing any overdrive from reaching later stages. Q889 is an emitter-follower, providing a low-impedance drive signal to paralleled transistors Q901 and Q902. C905 and R906 provide high-frequency compensation. Q901 and Q902 provide quasi-complimentary drive to output amplifiers Q912 and Q922. The inverter and amplifier formed by Q925 and

Q922 handle all low-frequency components of the ramp, while Q912 carries the high-frequency components.

X and Y Ramp Generators

Introduction

The X and Y Ramp Generators provide scanning potentials for the reading beam in the R7912 Scan Converter tube. Since the read beam scanning format used for TV (Non-Store) mode differs from that used for Digital mode, the circuits must each provide two distinct ramp types. The TV mode ramps are familiar 0V-10V complementary ramps synchronized to vertical and horizontal sync pulses. The vertical scanning format required for Digital mode is produced by carefully controlled step ramps that move the read beam over the target surface in small increments.

The circuits for the X and Y Ramp Generators are nearly identical, so they will be discussed at the same time. Schematics are located on Diagrams number 5 and 6. The discussion refers to Schematic 5 (Y Ramp Generator) only.

Description

Generating the Ramp. The ramp generation portions of both the X and Y Ramp Generators operate in the same way whether in TV or Digital mode. The ramp portions consist of the circuitry illustrated on the right half of Diagram 5. The dividing point is Q360, a dual FET operating in conjunction with Q365 as a Miller integrator. The integrator produces a positive-going 10-volt ramp at the collector of Q365. This signal is passed through R366 and P366 to the Video Processor board. The ramp is also used to provide drive signals for the paraphase amplifier formed by Q370 and Q385. These transistors provide complementary ramps corresponding to 50 millivolts/division (into 50 ohms) of read beam displacement. These ramps are provided at the D or P Interconnect connector at the rear of the R7912.

Amplitude Control. The upper and lower limits of ramp voltage are closely controlled by U395 and U415 in the upper right portion of the schematic. These devices are transistor arrays packaged in dual-in-line packages. Connected as shown, the transistor arrays perform a comparator function. When the 10 volt upper ramp limit is reached, the right half of U415 turns off, pulling up the base of Q420. As Q420 turns off, its collector delivers a negative-going reset signal to the R-S flip-flop formed by U425A and C. The resulting high on pin 3 of U425A turns Q427 on, producing the $\overline{\text{Y RETRACE GATE}}$ signal. This retrace signal is held

until the ramp voltage drops back to the 0 volt level.

Ramp termination is accomplished by Q430 and Q432. The high at pin 3 of U425A turns Q430 off and Q432 on. Current through Q432 rapidly discharges C368 (located under the dual FET at schematic center), the Miller integrator capacitor. When the ramp drops to 0 volts, the lower limit comparator (composed of U395 and associated components) turns on, pulling down the base of Q405. As Q405 turns off, pin 9 of U425C is pulled down to about 0 volts. This sets the flip-flop, and pin 3 returns to a low level. The low signal turns off Q432 and allows Miller Integrator capacitor C368 to begin charging again. As the ramp increases to 10 volts, the cycle repeats.

Synchronizing the Ramp in TV Mode. Both the X and Y ramps must be precisely synchronized with the vertical and horizontal sync pulses. This is accomplished in TV mode by the circuitry shown at the lower left corner of the schematic.

U300 is a phase detector that compares the Y ramp gate signal generated by U425C with a reference gate signal. If the two signals are exactly in phase, pin 2 of U300 is high and pin 10 is low. CR302 and CR306 are reverse-biased, and the voltage at the junction of CR304 and CR305 is simply the result of the voltage divider formed by the two diodes and resistors R306 and R302. This voltage is compared to a reference voltage by U310, a comparator-connected operation-

al amplifier. The output of U310 provides dvmve current to Q355, a unity gain transistor. Current through Q355 charges C368, the Miller integrator capacitor, and controls the rate of rise (or slope) of the ramp.

If the ramp drifts out of phase, U300 detects the phase difference and changes its pin 10 and pin 2 output in response, forward biasing either CR302 or CR306. The direction of phase shift determines which diode will be turned on. If the ramp is fast for example, pin 10 of U300 goes high, forward biasing CR306 and reverse biasing CR305. Current through CR304 and R302 then raises the potential at pin 2 of U310, causing its pin 6 output to swing more negative. This reduces the charge current supplied to the integrator capacitor, thereby reducing the slope of the ramp. It then requires slightly more time for the ramp to reach its 10-volt peak, so the ramp has effectively been slowed down to restore synchronization. The allowable rate of change of the control current from U310 is held to low values by R309 and C310. This relatively slow reaction time makes the circuit less sensitive to noise spikes.

Generating the Step Ramp. In Digital mode, the X and Y Ramp Generators must produce staircase ramps to step the reading beam over the target surface. The vertical scanning format requires that the Y Ramp Generator produce 512 steps on each ramp, pausing at each step for 100-nanoseconds. After each 100 nanosecond step, the circuit is allowed to

ramp upwards for 10 nanoseconds. Figure 3-7 describes the Y ramp.

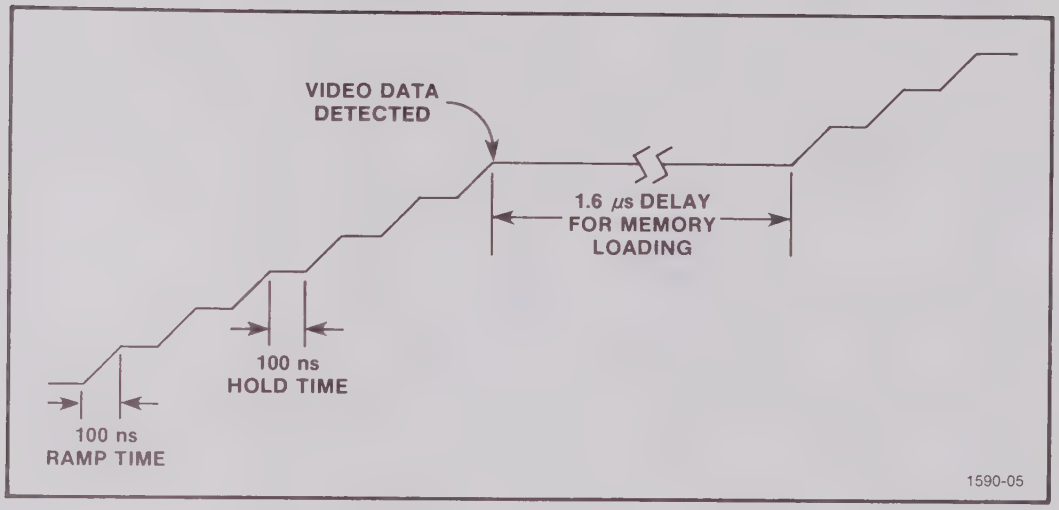


Fig. 3-7. The Y step ramp.

The X Ramp Generator must produce the same type of ramp, but much more slowly. Only one X-step increment occurs for every 512 Y-step increments. Figure 3-8 describes the scanning format.

The circuitry to the left of Q360 controls the staircase ramp generation. Notice that two signals ($\overline{\text{Y TRIG}}$ and $\overline{\text{Y START}}$) enter the circuit from the top left. $\overline{\text{Y START}}$ is a low-going enable signal from the Data Address Counter that occurs when the instrument is operating in Digital mode. It sets R-S flip-flop U320B and C, and pin 8 of U320C goes high.

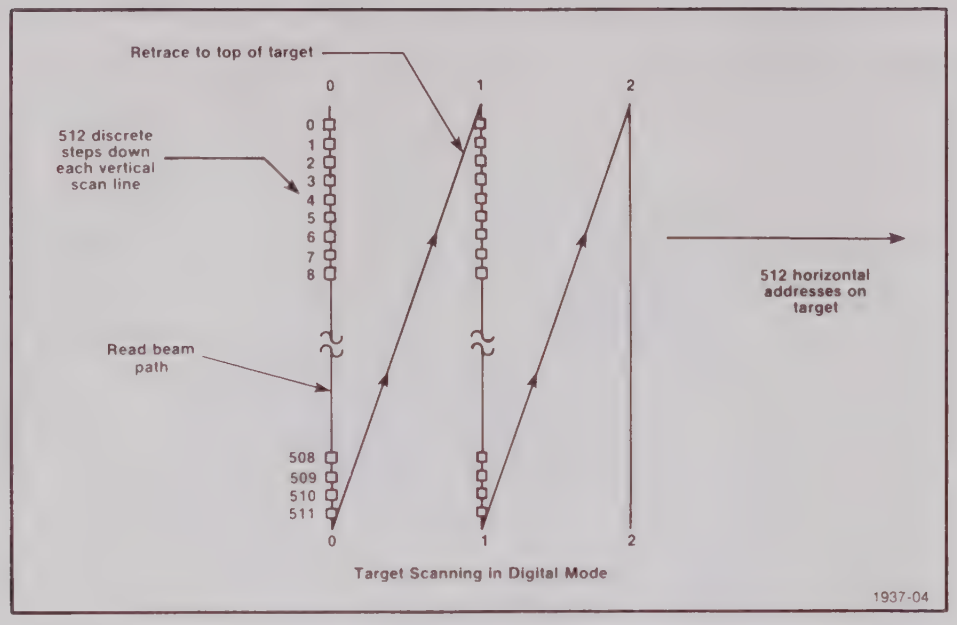


Fig. 3-8. Scanning format in Digital mode.

The high enables U320A, allowing it to pass signals present on its pin 2 input. The $\overline{\text{Y TRIG}}$ signal originates on the Data Address Counter circuit card (Schematic 12) and consists of series of low-going pulses occurring with a 200 nanosecond period. This pulse train determines the number of steps on the staircase ramp.

The pulses are passed by U320A to one-shot U325. Notice that the pin 3 input of U325 goes through R326 to the $\overline{\text{DIGITAL}}$/DISPLAY line. This line is high when operating in TV mode, and low when operating in Digital mode. The low Digital mode level turns on Q350, which reverse-biases CR351. This diode provided a charge-current path for C368

while in TV mode, but it has no effect during Digital mode operation. Charge current for the Digital mode ramp is provided by Q345 through R343, R342, and CR340. Ramp control is effected by U300 and U310 as in TV mode, except that the synchronizing $\overline{\text{Y REF}}$ signal comes from the Data Address Counter (schematic 12). The control output of U310 changes the base drive to Q345, varying the charge current to C368.

One-shot U325 has a 100-nanosecond unstable state. It fires on the falling edge of the $\overline{\text{Y TRIG}}$ signal (which has a 200-nanosecond period) and its Q or $\overline{\text{Q}}$ output goes low. This low level pulls the base of Q340 down, turning that transistor off. The emitter voltage of Q340 falls, forward-biasing CR340 and connecting the integrator charge current path through Q345. When C368 starts charging, the ramp starts rising. It rises until U325 times out (100 nanoseconds), and then holds until the next $\overline{\text{Y TRIG}}$ pulse occurs (another 100 nanoseconds). R322 (above U325) is provided so that the ratio between the ramp time and the hold time can be precisely adjusted.

When data is encountered on the target, the Y ramp must stop for about 1.6 microseconds. This delay provides sufficient time for the vertical address to be loaded into the local semiconductor memory (option 6). To provide the additional hold time, the $\overline{\text{Y TRIG}}$ signal from the Data Address Counter card is interrupted. The lack of a $\overline{\text{Y TRIG}}$

pulse prevents U325 from firing, and the ramp hold time is increased.

Paraphase and Scan Amplifiers

Introduction

The Paraphase and Scan Amplifiers accept the 10-volt X and Y ramps from the X and Y Ramp Generators. These two ramps are further amplified to provide read gun deflection voltages for the Scan Converter tube. As indicated on schematic 7, the output voltage for the Y deflection plates swings from about 207 volts up to 276 volts.

The X and Y portions of the Paraphase and Scan Amplifiers are very similar. The following description considers the Y portion (upper half of the schematic) only, except where significant differences exist.

Description

X and Y Ramp Amplifiers. The input signal for the Y ramp amplifier is applied to the operational amplifier formed by Q1010 and Q1015 (upper left corner of the schematic). The left base of Q1010 is a summing point for three currents: 1) the ramp current through R1000 and R1001, 2) the Y centering current through R1004 and R1006, and 3) the scan rotation current from R1087 and R1097 in the X paraphase amplifier.

The gain of Q1010 and Q1015 is set at about 0.7 by input resistors R1001 (Y Gain) and R1000, and feedback resistor R1018. C1018 provides high frequency peaking for the circuit. The grounded right base of Q1010 assures a ground-level voltage at the left base, and also temperature-compensates the pair. Output from the right half of Q1010 is developed across R1013 and applied to Q1015. CR1016 protects this transistor from puncture should Q1010 be removed from its socket. LR1015 isolates the high-speed step ramp (Digital mode) from the power supply. Q1015 is also connected as an emitter-follower, and it drives the first stage of a paraphase amplifier formed by Q1020A and Q1020B (a dual transistor). Q1025 provides a temperature-compensated, constant-current source for the emitters of the two transistors.

Notice that the first three transistors in each half of the paraphase amplifier are op-amp connected. The feedback resistors in each half are R1043 (top half) and R1033 (bottom half). The difference in value of these two resistors compensates for some inherent inbalance in the paraphase amps. C1029 provides high-frequency peaking. Note that peaking is not necessary in the slower X ramp amplifiers. Diode protection for Q1020A, Q1044, and Q1045 is provided by CR1020 and CR1046. The lower portion of this amplifier (Q1020B, Q1034, Q1035) is similarly protected. The Y Scan Rotation control (R1047) picks off a sample of the Y ramp and applies it to the input of the X ramp amplifier.

Similarly, the X Scan Rotation control applies signal from the X ramp amplifier output to the Y ramp amplifier input. This cross-coupling allows adjustment of both trace rotation and X-Y alignment.

The output of the X and Y ramp amplifiers is a level-shifted pair of complementary ramps; the X ramp ranging from -5 to +5 volts, and the Y ramp ranging from -3.45 to +3.45 volts. The amplitude difference reflects the 3:4 aspect ratio of the scanned target area. The output ramps are connected to the scan amplifiers (right half of Schematic 7) by coaxial cables.

Scan Amplifiers. The scan amplifiers accept the two pairs of complementary ramps from the paraphase X and Y ramp amplifiers. The ramps are amplified and level-shifted to the potentials required by the Scan Converter tube.

Starting at top center of Schematic 7, note that the upper Y ramp signal is applied to the base of Q1110. Output from this emitter follower is applied to common emitter amplifier Q1112, and from the collector of Q1112 to common base amplifier Q1114. The collector current supply for Q1114 consists of the constant-current source formed by Q1115 and VR1117. Base voltage for Q1115 is set by VR1117, and that establishes a constant emitter voltage. The resulting current through R1115 supplies Q1114. The signal current supplied by Q1112 is applied to the emitter of Q1114. The difference between applied signal current and

the current source contribution drives the deflection plate capacitance. LR1119 shapes the current for the feedback loop composed of Q1123A and B, resistors R1120, R1121, R1122, R1124, and R1125. Q1123B is diode-connected, and forms a part of the voltage divider consisting of R1120, R1121, R1122, and R1125. The divider is tapped at the bottom of R1121 and R1122, with the resulting voltage applied to the base of Q1123A. Current through Q1123A controls feedback (and thereby the gain) of the amplifier. Normal gain is very near 10. As before, the lower circuitry operates in a similar manner.

Reading Gun and Preamp

Introduction

The Reading Gun and Preamp circuits (Schematic 8) include a low-noise video preamplifier for the video information written on the Scan Converter diode target, control amplifiers for focus and X-Y alignment of the read beam, and a special cathode current regulator. The video preamp occupies the top-right portion of Schematic 8, with the X-Y alignment circuits immediately below. At the bottom right is the cathode regulator, and the left half is devoted to focus and accelerator circuitry.

Description

Video Preamp. The video preamplifier accepts video signals in the nanoamp range from the diode target. Special care in the design of the amplifier was required to handle such low-level signals. The voltage divider formed by R1951 and R1952 sets the DC voltage level of the target with respect to the cathode. The required level is specific to each Scan Converter tube, and is marked on a label affixed to the writing gun end of the tube.

Video signals pass through C1956 to Q1957, a parallel-connected dual FET. Output is developed across R1959, driving emitter-follower Q1962. Common-emitter connected Q1965 then inverts the signal and applies it to emitter-follower Q1968. Q1973 is collector loaded and provides both output for the next stage and feedback for the video preamp through R1957. R1957 is a special low-noise resistor, and its high value allows high stage gain for this op-amp-connected amplifier. A shorter feedback loop within the amplifier chain is included. R1961 is the feedback resistor for this inner loop.

The output stage consists of a 5-transistor array packaged in a 14-pin DIP (U1983), and output transistor Q1991. The signal from Q1973 is direct-coupled to two darlington-connected transistors in U1983. The array transistor connected between R1985 and R1986 is diode-connected. This diode connection assures the proper potential for the array

substrate at pin 3 of U1983. The left half of the array is connected as an emitter-follower driving a common-base amplifier. Output is taken across R1989 to drive Q1991, which provides a 5 millivolt/nanoamp drive for the video processor circuitry. Note that the schematic indicates 1 millivolt/nanoamp into 50 ohms. This is a calibration aid only. The input impedance of the video processor is approximately 300 ohms.

X and Y Alignment. The X and Y alignment circuits are located directly below the video preamplifier on Schematic 8. The two circuits are identical, so only the X alignment circuit will be discussed.

The alignment coils are doughnut-shaped and mount on the sides of the Scan Converter tube. The schematic incorrectly implies that the coils wrap around the tube. The coils accept a current of either polarity (whichever is required for proper alignment) from the X alignment drive transistors, Q1935 and Q1925. The voltage divider formed by R1933, R1931, R1929, R1928, and R1927 provides base drive for the transistors under control of R1930, the X alignment adjustment. This control provides a variable drive for one or the other of the two transistors, depending upon its resistance setting. Depending on which transistor is turned on, current from either the +15 or -15 volt supply is provided through a 200 ohm resistor to the alignment coil. Diodes CR1933 and CR1927 temperature compensate the transis-

tors.

Cathode Current Regulator. The cathode current regulator circuit is shown at the bottom right of Schematic 8. It regulates both cathode current and control grid voltage in response to retrace blanking signals, and automatically compensates for the effects of cathode aging in the Scan Converter tube.

Beginning at the NOR gate (U1871) at the right edge of the schematic, notice the two inputs to the gate. Composite Retrace Blanking is a positive-going pulse lasting for the retrace time of the read beam X or Y ramp voltage. $\overline{\text{LOAD DELAY}}$ is normally high, going low for 100 microseconds following an event that causes target data to be loaded into memory. The signal cannot occur if the R7912 is operating in TV (NON-STORE) mode. The $\overline{\text{LOAD DELAY}}$ input was deleted from later instruments.

For this description, we'll assume that $\overline{\text{LOAD DELAY}}$ is high, and that a Composite Retrace Blanking pulse is present. Both inputs to U1871 are high, and its output goes low to cause blanking of the read beam. The low output reverse-biases CR1875 and forward-biases CR1876. These diodes are operating as a solid-state switch, either connecting or disconnecting R1875 and R1876. With CR1876 forward-biased, R1875 is connected, and the right base of Q1878 is pulled down. The forward-biased right half of Q1878 cuts off the left half, removing drive from the base

of Q1882. When Q1882 cuts off, it disconnects the -15 volt supply from R1883, and its collector swings positive. The cathode current path (hole current) is now through R1883 and R1886 to the cathode. The current is such that the cathode voltage swings to a positive 12 volts. The target potential is only about +3 volts, so no beam current reaches the target. It is entirely absorbed by the highly positive mesh located between the cathode and target.

When the end of the blanking interval occurs, the Composite Retrace Blanking pulse drops low, disabling U1871. Its pin 8 output goes high and the CR1876-CR1875 diode switch is reset, disconnecting R1875. The right base of Q1878 swings positive and cuts off that transistor, which turns on the left transistor of the pair. The left collector of Q1878 swings positive and forward-biases Q1882. The collector of Q1882 drops to near -15 volts, and current through R1886 to the cathode sets the cathode potential at about -6 volts. The +3-volt target potential and the -6 volt cathode potential leave a net 9-volt difference between the two, and a percentage of beam current again reaches the target.

Cathode current remains the same (about 750 microamps) whether blanked or unblanked. The current is sensed as it passes through R1886. The resulting voltage drop across the resistor is applied to the inputs of differential amplifier U1892. The output of U1892 drives the base of Q1898, and

that transistor controls the first grid voltage of the Scan Converter. The actual voltage is specific to a particular Scan Converter tube, but it is usually about 20 volts more negative than the cathode when blanked.

Focus and First Anode Control. The focus circuitry is represented on the left half of Schematic 8. Starting from the top left, note the focus anode supply circuit. It consists of a simple divider supplying about 250 volts to the focus anode at pin 6 of the Scan Converter.

The focus current regulator is just below the focus anode supply. Current from the +50 volts supply is passed by Q1821 through the focus coil, and to ground through R1823. Nominal current through the coils is about 37 milliamperes. The voltage developed across R1823 by the focus current is applied to the base of Q1814. The Magnetic Focus control (R1809) adds or subtracts a small amount of current to provide a $\pm$ 2 milliamp adjustment range. Q1814 temperature-compensates the circuit and establishes a reference voltage with VR1815. If the current through the focus coil increases, more voltage is developed across R1823. The left half of Q1814 turns on slightly, and the right half turns off slightly. This causes the right collector to swing more positive, and Q1821 receives less base drive. Q1821 then reduces the focus coil current.

The voltage applied to the first anode (pin 5 of the Scan Converter) is controlled by U1831 and Q1834. To maintain a small spot size, the focus coil current and the first anode voltage track each other. The pin 2 input of operational amplifier Q1831 is connected through R1825 to the focus coil circuit. When the focus current is reduced by adjusting R1809 more toward its +15 volt end, the slight voltage increase is sensed by U1831 and used to control Q1834. When pin 2 of U1831 rises, pin 6 drops, providing less drive for Q1834. The collector of Q1834 rises, and the first anode voltage rises. R1827 controls the overall gain of the circuit and sets the quiescent anode voltage level.

The heater current for the Scan Converter tube (bottom of Schematic 8) is closely controlled by Q1853. The divider formed by R1850 and R1851 sets the voltage while CR1851 temperature-compensates the transistor. The low cold resistance of the filament at turn-on causes Q1853 to saturate until warmup. R1853 provides current limiting until the heater resistance rises enough to bring Q1853 out of saturation.

Video Processor

Introduction

The Video Processor accepts video signals from the video preamplifier. The video information is amplified and carefully corrected for aberrations caused by diode leakage in the Scan Converter target. The corrected video information is routed to three different circuits, each providing a special output. The video LINEAR output is simply a blanked and level-shifted version of the raw video, and is designed to drive standard TV monitors using a separate SYNC signal. The video BINARY output provides a two level off-on output signal that produces no grey scale on a TV monitor screen. The video COMPosite output consists of binary video with sync pulses added. A sync OUT signal is also provided that contains no video, but synchronizes external equipment with the other R7912 video outputs.

A simplified block diagram of the Video Processor is given in Fig. 3-9. The Processor circuits are represented on Schematic 9. Note on the schematic that all the circuitry in the lower left quadrant is devoted to correcting the video signal for the effects of target leakage.

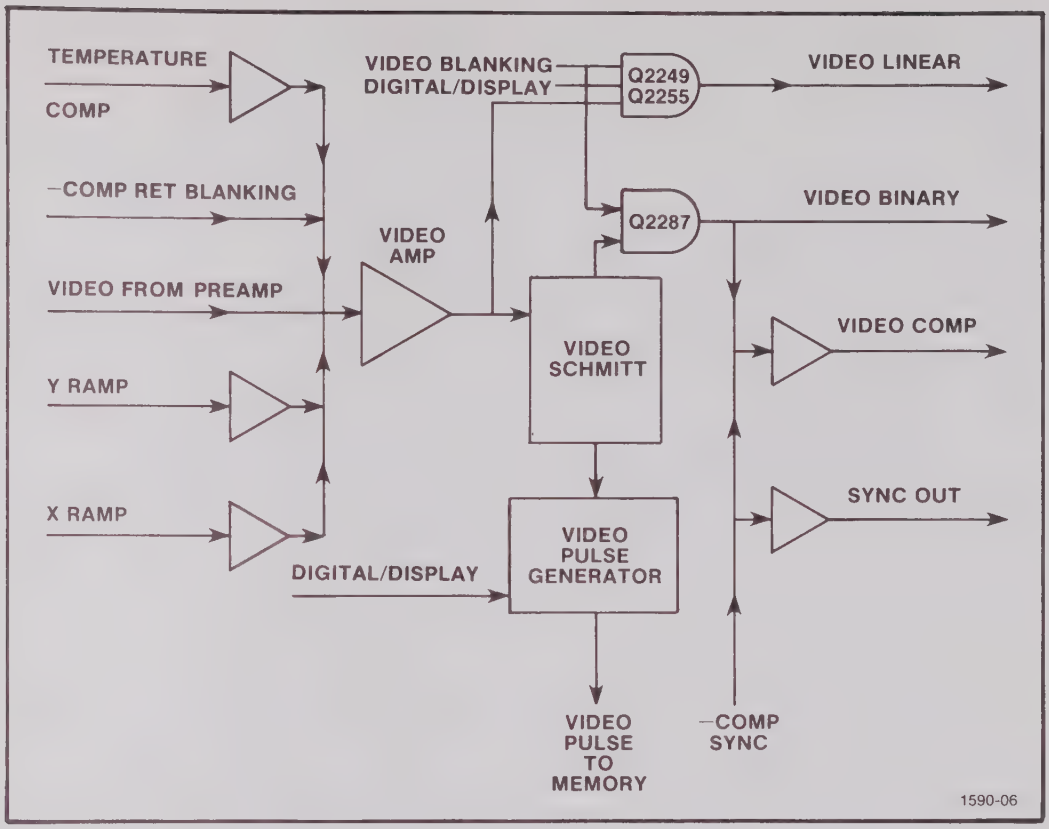


Fig. 3-9. Video Processor block diagram.

Description

Video Amplifier. Beginning at the left edge of Schematic 9, slightly above center, notice the VIDEO FROM PREAMP connector. The low millivolt signals from the video preamplifier enter via coaxial cable at that point. The R-L-C network at that input constitutes a 4-pole butterworth filter with a 4.5 megahertz cutoff frequency. All of the video information occurs below 4.5 megahertz, and the filter serves to reduce high frequency noise. The filtered

video signal is AC coupled through C2220 to the gate of Q2222A. Q2222B serves as a constant-current source for the stage. Output is developed across R2223 and applied to the base of Q2228. Q2232 and this transistor pair are connected as an operational amplifier. R2225 is the input resistance and R2235 is the feedback resistance. The transistor pair temperature compensates the amplifier. Output from Q2232 is taken across R2234 and applied to the three output circuits mentioned in the introduction. We'll discuss them in detail later.

Target Leakage. As mentioned previously, the diode target in the Scan Converter tube has a small amount of leakage current. The leakage current is seen as a slowly varying video baseline signal produced as the reading beam sweeps across the target. Every Scan Converter target has a slightly different leakage "profile" across its surface, so each instrument must be calibrated to best suit its target characteristics. Target temperature also affects the leakage current. While the basic shape of the leakage profile doesn't change significantly with temperature, its amplitude does. Figure 3-10a illustrates the problem. This leakage current must be accurately compensated to allow detection of valid target data in the video signal.

Correcting the Video. The video processor correction (shading) circuits sample the X and Y ramps that seep the read beam across the target. Using the ramp information,

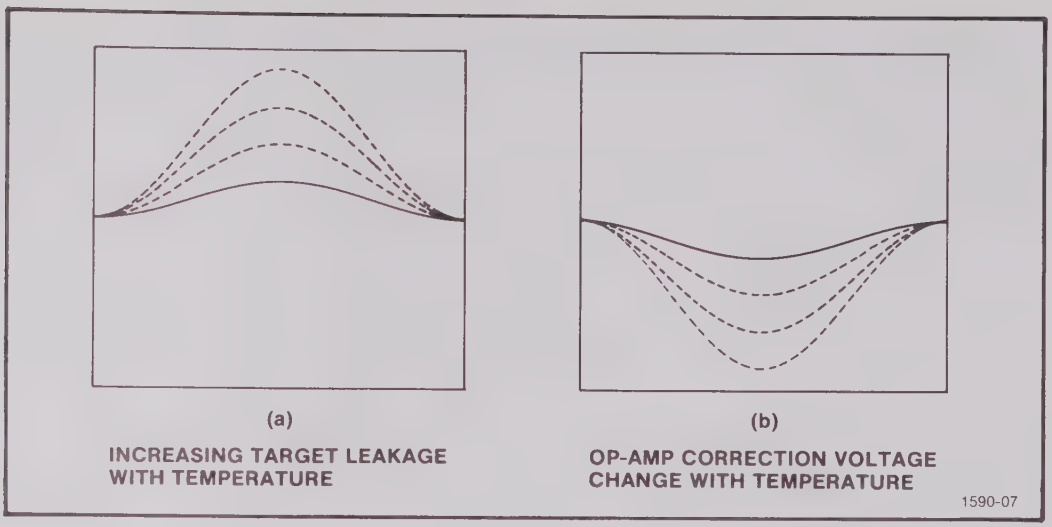


Fig. 3-10. Correcting for thermal leakage.

the circuits produce a correction voltage that varies in magnitude as the beam travels across the target. The properly adjusted correction voltage just cancels the target leakage at any point in a scan. Additional correction for temperature effects is provided by monitoring the Scan Converter tube temperature and adjusting the gain of the correction circuits accordingly. Figure 3-10b describes an idealized correction voltage.

Looking at the circuit in detail, notice the Y RAMP signal entering at the left edge of the schematic. The ramp voltage at that point ranges from 0 to 10 volts positive. The combination of R2160 and R2161 level-shifts the ramp so that it ranges from -5 volts to +5 volts, providing drive for Q2164 and Q2169. While the ramp is rising from -5

volts, Q2164 conducs, pulling down on the emitter of Q2173. Pin 3 of operational amplifier U2178A rises, and the pin 1 output of the op-amp follows. Stage gain is approximately 0.4 at this point, so the output rises to about two volts as the input ramp reaches 0 volts. The ramp continues to rise, and the now positive signal turns Q2164 off and Q2169 on. The collector of Q2129 gradually rises with the ramp, pulling up on the inverting input of U2138A. The output of U2138A begins to drop back to 0 volts. When the input ramp reaches +5 volts, the output is again 0 volts.

Figure 3-11 describes the op-amp output. The peak point in the output waveform is always the zero crossing point of the input ramp. By adjusting R2167 (Y Symmetry), the crossing point can be shifted back and forth to suit the target characteristics.

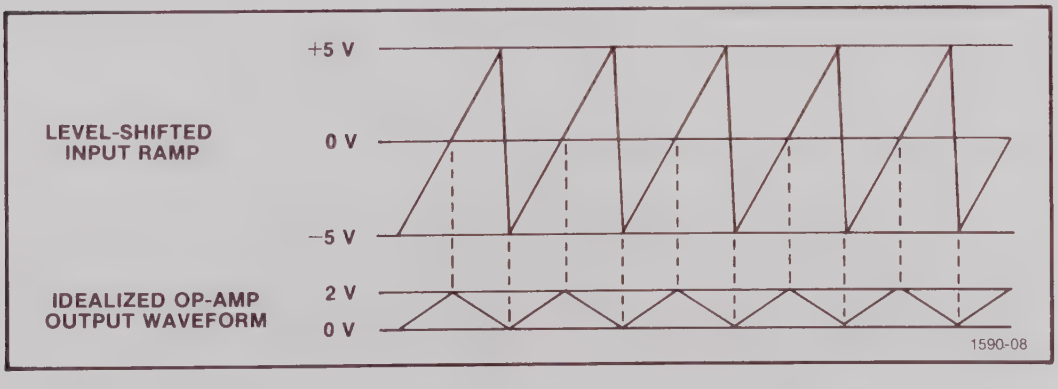


Fig. 3-11. Generating the correction voltage.

The output of U2178A drives an NPN transistor (U2190E) that serves as a current source for the two transistors shown just above it on the schematic (U2190A and B). These three transistors are part of a five-transistor array, U2190. U2190A and B are differentially connected to U2178B, providing a temperature-compensated; input to that op-amp. Gain is controlled by setting the base of U2190B above or below ground slightly with R2187 (Y GAIN). When the lower current-source transistor is driven by U2178A, the current through the upper transistors is slightly unequal, due to the setting of R2187. A voltage difference is developed between R2192 and R2194 and applied to U2178B. The output of U2178B is AC-coupled through C2198 to the null point of the video amplifier, Q2228-Q2232, where it is summed with the video signal. Figure 3-12 summarizes the correction process.

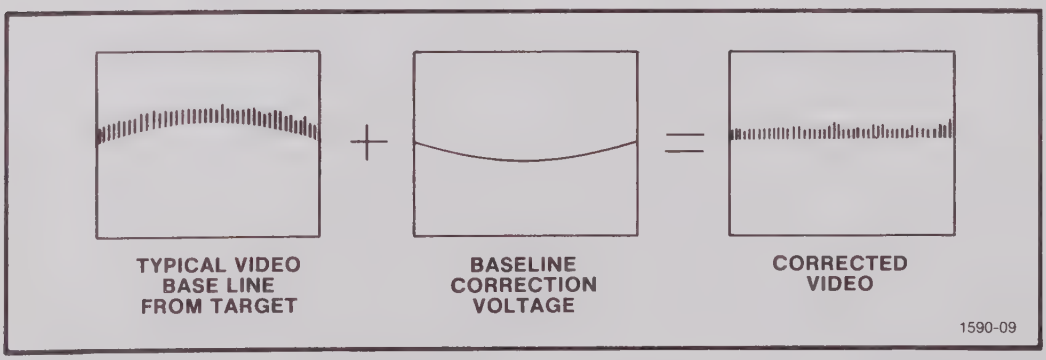


Fig. 3-12. Correcting the video signal.

Notice that the Y Gain control (R2187) is not the only input to the base of the gain control transistor U2190B. Current through R2189, contributed by the operational amplifier at the upper left corner of the schematic, also affects the gain of the amplifier. This op-amp (U2208) senses the target temperature with a special circuit using CR2205 as a sensor. R2201 provides a fine adjustment for different target characteristics. Current from the output of U2208 is applied to both the X and Y correction circuits, increasing their gain (and therefore the correction voltage) as target temperature increases.

Retrace Blanking. The output of U2208 is also connected through Q2215 to the gate of Q2222A. When Q2215 is turned on by a COMP RETRACE BLANKING signal, the positive output of U2208 is applied to Q2222A. This positive DC level prevents the negative-going video signal from being possed by the amplifier.

LINEAR Video Output. The corrected video signal is distributed between three output circuits. The circuit represented at top center of the schematic provides linear video output.

Linear video consists of the corrected video signal with blanking pulses added. The blanking signal is a positive-going square wave as shown near J2238. The positive signal forward-biases Q2249, pulling the base of Q2255 toward ground. The emitter of Q2255 pulls down to near

ground in response, and this ground level output is the blanked video. Ground is full black; one volt is full white. Blanking can also occur when the $\overline{\text{DIGITAL}}$/DISPLAY line (P2240) is low (Digital mode). Video output during Digital mode operation is not usable, so the output is held blanked (ground level) in that mode.

When the blanking signal is removed, Q2249 turns off. The base of Q2255 rises, and it operates as an emitter follower. Video output signals range from ground level up to one volt into 75 ohms, and are compatible with most video monitors.

BINARY Video Output. The binary video signal is a two-level representation of the continuous target signal. When the signal increases beyond a set threshold, a full white signal is produced. When the video drops below the threshold, a ground level or full black signal is produced. The threshold level is adjustable, and it provides a means of rejecting noise and minor target defects that fall below the threshold.

The threshold level is set by R2266 (DC Schmitt) and it affects a very low-hysteresis Schmitt trigger circuit composed of U2275A and B. One output drives emitter follower U2275C. The output from the emitter of U2275C is coupled to U2275D. Current through U2275D flows through R2283 to the -15 volt supply when the Schmitt input transistor is off. When the input transistor turns on, U2275C

turns off, removing drive current from U2275D.

Grounded-base amplifier U2275D adds a DC offset to the Schmitt output which is compensated for by VR2286, a 6.2-volt zener diode. The on-off signal drives the base of Q2289, another emitter follower. A blanking signal is added through CR2262 and R2262, and the signal is applied to the bases of U2345E and G. U2345E produces 1 volt of video (full white) into 75 ohms at the video BINARY connector on the R7912 rear panel. U2345G is collector loaded, and the video signal developed across R2323 drives both U2345A (which provides a video signal for other circuits via J2326) and the video COMPosite output on the R7912 rear panel.

COMPosite Video Output. The sync signal from the Sync Generator (Schematic 11) must be added to the video signal present at the COMPosite output. The signal enters via J2347 as a low-going TTL-level pulse. The low signal pulls down the anode of CR2348 and allows current through R2348 to pull down the base of U2345D, turning that transistor off. Its collector voltage rises and U2345B turns on. The collector voltage of U2345B falls, reverse-biasing CR2343 and CR2344. Since the sync pulse occurs during the blanking interval, U2345G is on. As CR2343 and CR2344 become reverse-biased, current through R2344 pulls down on the video COMP output, reducing the signal to about -0.4 volts during the sync interval.

SYNC Out. The sync pulse from the collector of U2345D also drives the base of U2345C. The signal is amplified and inverted by that transistor, then applied to a complementary emitter follower pair composed of Q2357 and Q2360. The complementary pair assures a fast rise and fall time for the output signal, which is AC coupled to the sync OUT connector on the R7912 rear panel. The sync signal amplitude is about 4 volts into a 75 ohm load.

Storing Target Data. The Schmitt trigger output is used to provide a strobe pulse to the R7912 memory circuits when operating in Digital mode. Recall that Digital mode operation results in a vertical scanning format for the reading beam. Beam position is closely controlled by the X and Y step ramps discussed earlier (see X and Y Ramp Generators in this section). The beam steps are produced under control of a pair of binary counters (on the Data Address Counter card), one counting the current horizontal beam location (step number) and the other counting the vertical beam location (step number). When video is detected, the read beam stops for 1.6 microseconds and a pulse from the video processor causes the memory control circuits to store the current vertical location of the read beam (the vertical counter value) in memory. The horizontal position is automatically stored whether video is detected or not.

Generating the Video Pulse. The complementary output of the Schmitt trigger that occurs at the collector of U2275B (center of schematic) goes high when video is detected. The high turns Q2292 on and its collector drops to near ground potential. The low is inverted by U2296A, and the resulting high clocks flip-flop U2300B. The low from Q2292 is also applied to the clock input of U2300A, but this flip-flop is sensitive only to a positive-going signal. Both flip-flops have their 0 outputs connected to their respective "D" inputs, forcing them to change state with every clock pulse received. Notice that both have their clear inputs tied high through R2306. Prior to the first video pulse, both flip-flops are in a preset state -- the 1 output high, the 0 output low. The high clock signal applied to U2300B causes it to clear (from its preset state) and its 0 output goes high. The high fires one-shot U2315A. The 1 output of U2315A delivers a 2.4-microsecond video pulse to the memory circuits, indicating leading-edge detection of the target data.

If the trace on the target is relatively thick (several vertical addresses), many video pulses might be produced as the read beam traverses the written trace. Since memory size is limited, only the leading and trailing edge of the trace are detected and stored.

To get an idea how this leading and trailing edge detection is accomplished, let's discuss the video signal from the target as a trace is detected. First, consider a fairly fat trace (intensity set a little high). As the read beam steps downward in 100 nanosecond steps, it eventually encounters the top edge of the written trace. Video is detected, and the ramp is stopped at that point for 1.6 microseconds. The memory circuits get a video pulse from the one-shot we just discussed, U2315A. Video is detected, and U2315A delivers a video pulse to the Data Address Counter circuits (Schematic 12). The video pulse causes the address counters (which control the ramp steps) to pause for 1.6 microseconds, holding the read beam steady for that time.

During this pause, the read beam dwells on one spot on the target surface. Remember that the writing beam normally discharges the target diodes, and the read beam recharges them. When the read beam dwells on one spot, it gradually charges a larger and larger area of the written trace. After the leading edge of a trace is stored and the vertical scan resumes, the first few 100 nanosecond steps may be through an area that was originally written (and discharged) but recharged by the stopped read beam. As the beam steps out of this charged area, a new "leading edge" would be detected. The video output might look like that shown in Fig. 3-13.

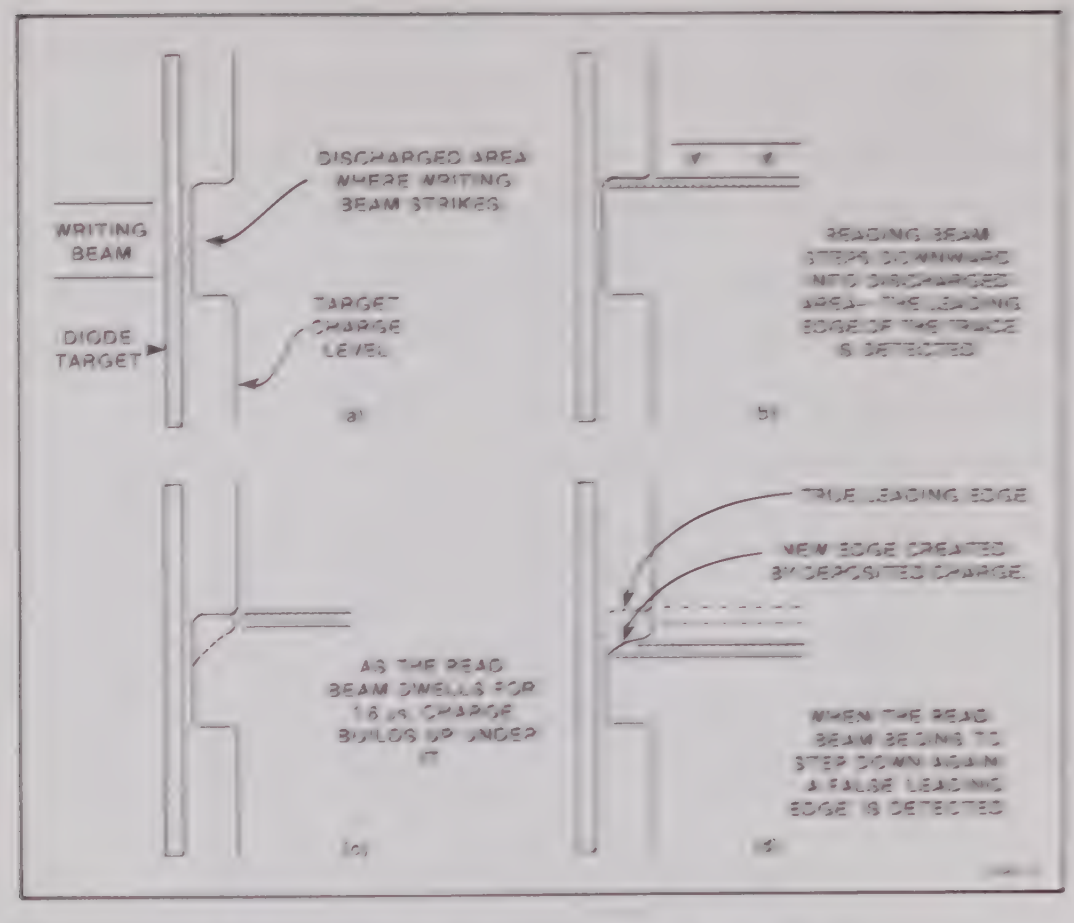


Fig. 4-16. Leading-edge detection.

To prevent this false signal from being stored in memory, the video pulse one-shot (U2315A) has a period of 2.4 microseconds, 800 nanoseconds longer than the pause time of the read beam. The overlap prevents any more video "edges" from being detected until the read beam has stepped out of the recharged area. The video information is effectively "ignored" by connecting the 0 output of U2315A to the preset inputs of U2300A and B. Holding the preset line low prevents any video information that occurs during the 2.4 microsecond period of the one-shot from clocking either

flip-flop. After U2315A times out, the preset inputs to U2300A and B are released. Any change in video information occurring after time-out clocks one of the flip-flops.

If video is still present when U2315 times out (read beam still stepping through a written target area), the video signal remains high (not affecting either flip-flop) until the read beam leaves the written trace. Then the video disappears and the collector of Q2292 goes high. The high transition clocks U2300A (which was preset, remember) and its 1 output goes low, firing one-shot U2315A. The 1 output also connects to the inputs of NAND gate U2296, but that gate is not affected by a low transition. When U2315A fires, its 1 output delivers the video pulse, as before. Its 0 output (delayed slightly by R2317 and C2314) again presets U2300A. The 1 output of U2300A returns high, and the high transition enables NAND gate U2296D. The inputs to this gate are capacitively coupled, so the gate produces a sharp low-going spike at its pin 11 output. The spike is inverted by U2296B and again by U2296C and then used to clear U2315A. Clearing the one-shot terminates its timing interval immediately, so the duration of the trailing-edge video pulse is approximately the "loop time" through the flip-flop and three gates, or about 50 nanoseconds.

As a final note, take a look at U2315B, the other half of the dual one-shot. It accepts the $\overline{\text{DIGITAL}}$/DISPLAY signal from the front-panel pushbuttons or from an external con-

troller. When the R7912 is switched from TV mode to Digital mode, it takes the X and Y ramp circuits several seconds to stabilize in the new scan format. U2315B fires when the mode transition begins and holds U2315A cleared for 1.2 seconds. This delay prevents any erroneous video pulses from being produced.

Graticule Generator

Introduction

The Electronic Graticule Generator produces a 9 X 11 array of dots that are written on the Scan Converter target along with any waveform data. The dot array simulates the familiar graticule lines on a standard oscilloscope screen, providing eight major vertical and ten major horizontal divisions. Four minor division 'tic' marks are also provided at 0.2 division spacing between each major division dot. The graticule is extremely accurate and stable, making it an ideal visual reference for waveforms displayed in TV mode on a suitable monitor. Figure 3-14 shows a typical monitor display with the full dot graticule.

The dot array can be digitized and stored along with an acquired waveform when operating in Digital mode. The quantity of dots in the full graticule causes rapid memory overflow, however. To avoid this problem, the Graticule Generator was designed to operate in two modes: Full, where all major and minor dots are produced; and Vertex, where

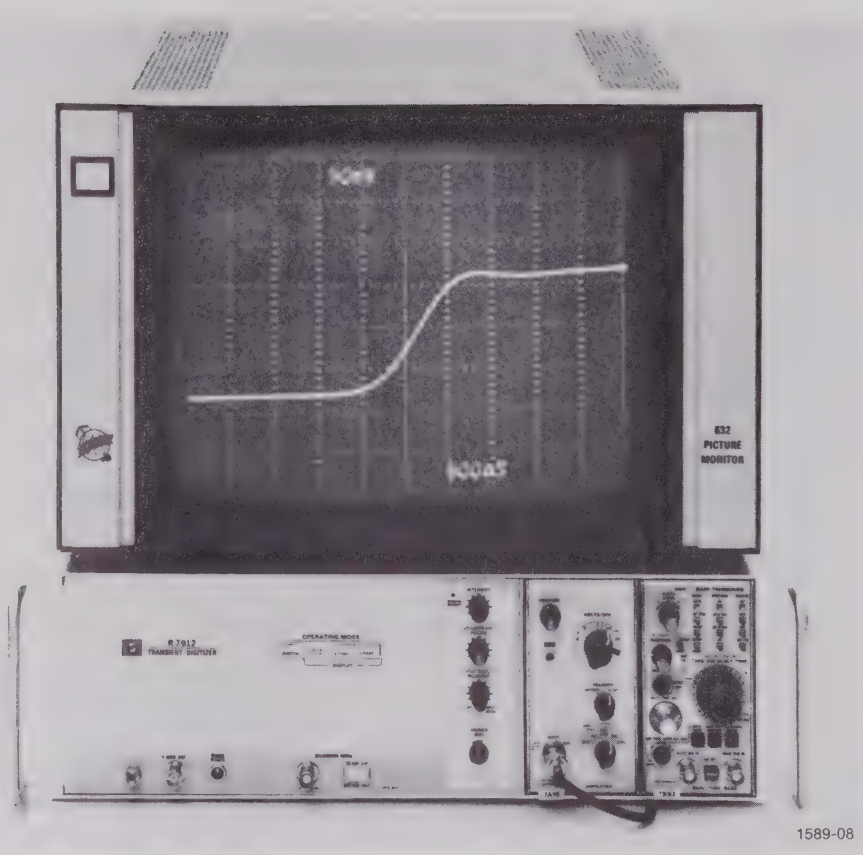


Fig. 3-14. The full Electronic Dot Graticule.

only the major division dots are produced. The operating mode is selected with a strap option on the Graticule Generator circuit board (P2435).

The digitized graticule array (Vertex mode) constitutes a frame of reference for highly accurate measurements of the acquired waveform. The signal paths for the input waveform and the graticule are identical, so any minor distortions or nonlinearities in the signal path affect both signals equally. Careful computer analysis of the graticule geometry allows correction of waveform distortion, resulting in very accurate data.

Overview

The Graticule Generator circuit is shown on Diagram 10. The graticule is generated on an alternate-sweep time-shared basis with the acquired waveform. After the waveform is written, the graticule generator senses the release of $\overline{\text{HOLDOFF}}$ and sets Sweep Lockout, preventing the horizontal ime base from initiating another sweep. The generator then sets the mainframe vertical and horizontal channel switches to ignore signals from the plug-ins and accept the graticule ramps.

The graticule is generated as a series of vertical dotted lines beginning at the left edge of the target. A vertical ramp generator moves the writing beam vertically over the target surface. During retrace after each vertical scan, the horizontal ramp generator steps an increment across the target, then waits for the next vertical retrace.

Z-axis signals derived from the crystal-controlled clock on the Sync Generator circuit card produce the graticule dots as the writing beam moves over the target. Since the ramp generators and the clock signals are highly stable, the resulting dot array is very accurate.

Description

Vertical Ramp Clock. Graticule Generator timing is derived from a 5-megahertz clock signal from the Sync Generator circuit card (Schematic 11). The clock signal enters Schematic 10 at the extreme upper left corner. Q2406 shapes the clock waveform and applies it to U2410. This counter divides the signal by eight. The resulting 625 kilohertz signal is further divided by U2412 and U2421 down to 13.89 kilohertz (at pins 12 and 13 of U2412). This signal fires one-shot U2419, which has a period of slightly over two microseconds.

The resulting signal (still 13.89 kilohertz) is applied to U2492 (at left center of the schematic). This device is a phase comparator as used in the X and Y Ramp Generator circuits. It compares the vertical ramp timing to the divided clock signal, correcting the ramp generator when necessary.

Ramp Generators. The ramp generators are similar to those used in the X and Y Ramp Generators as well. Both the vertical and horizontal graticule ramps employ Miller integrator circuits, with the vertical ramp integrator consisting of Q2518, Q2521, and Q2525, with C2519 as integrator capacitor.

Ramp output istaken from the collector of Q2525 and applied to a paraphase amplifier composed of Q2529A, Q2529B, and current source Q2535. R2540 sets the gain of the amplifier, while R2543 (Vert Position) sets the quiescent output level to adjust overall vertical position of the generated graticule. Nominal output corresponds to 50 millivolts/division of deflection.

Vertical retrace occurs when the ramp rises to the trip point of the upper limit comparator formed by Q2562A and Q2562B (below the Miller integrator). When the trip point is reached, Q2569 turns off for a short time (determined by C2569 and R2569 at its emitter), providing a negative-going pulse to the R-S flip-flop formed by U2458C and D. The flip-flop resets, and pin 11 of U2458D goes high. The high is applied to the phase detector (for comparison to the clock signal) and to the base of Q2511. Q2511 turns off, turning Q2514 on. This provides a discharge current path for Miller integrator capacitor C2519, and the ramp quickly drops to near zero volts.

When the ramp reaches zero volts, the lower limit detector (Q2578A and B, shown just below the upper limit detector) trips, setting the R-S flip-flop. As the flip-flop sets, Q2511 turns on again, turning off Q2514. The charge current path for C2519 (through Q2508 and R2508) is reestablished, and the ramp begins to rise again.

If the ramp reaches its peak too early, the phase comparator (U2492) causes operational amplifier U2502 to reduce the drive to Q2508. This reduces charge current to C2519 and slows the rate of rise of the ramp. Similarly, if the ramp peak is late, U2502 increases the drive to Q2508, speeding up the ramp.

The horizontal ramp also uses a Miller integrator, but a dual FET (Q2603) is used as the input device to reduce leakage-induced drift. The horizontal ramp time-constant is long compared to the vertical ramp, and it must hold steady at each step while the vertical ramp runs. The high input impedance of the FET provides the necessary stability.

Horizontal ramp timing is provided by the vertical ramp retrace signal. When the vertical retrace flip-flop (U2455C and D) is reset at the peak of the vertical ramp, pin 8 of U2458C goes low. The low level pulls down the voltage divider formed by R2590, R2592, and R2593; and the anode of CR2594 goes slightly negative. The diode turns off, and CR2595 turns on. Charge current for the Miller integrator flows through R2595 and CR2595 to C2625. The horizontal ramp begins to rise, and the writing beam moves over to its next position.

When vertical retrace is terminated, the R-S flip-flop sets and pin 8 of U2458C goes high. The divider voltage rises, and the anode of CR2594 goes positive. This diode conducts, pulling the anode of CR2595 high and switching it

off. No more charge current flows to C2625, and the low leakage diodes (and the high FET input impedance) prevent it from discharging. The ramp holds at this level until the next vertical retrace interval.

The horizontal ramp reaches its peak voltage in a discrete number of steps. The number of steps taken is monitored by counters at the top of the schematic. We'll discuss those shortly. When the counters determine that the proper number of steps have ocurred, a Horizontal Reset signal is generated. The signal is shown on your schematic at the lower left, and it drives Q2599. This transistor is on when the horizontal ramp is running.

Look to the right of Q2599 to diode-connected Q2615. As the ramp voltage rises, the top of R2616 rises as well. Q2618 begins to turn off, and its collector swings negative, turning Q2623 off. The collector of Q2623 rises, and the anode of CR2600 tries to rise. With Q2599 on, however, the diode cannot switch on. When Horizontal Reset occurs, the base of Q2599 goes low and the transistor turns off. The ramp is at five volts, and Q2623 is turned off. The collector of Q2599 rises, forward biasing CR2600 and discharging the integrator capacitor, C2625. The ramp drops immediately to zero volts. This low ramp voltage turns Q2618 and Q2623 back on and restarts the ramp, but it is only allowed to rise a few millivolts before Q2623 starts to turn off again.

The horizontal ramp drives a paraphase amplifier essentially identical to that used in the vertical ramp circuits. The two adjustments (Horiz Gain and Horiz Position) are functionally similar as well.

Startup Logic. The enable signal for the Graticule Generator can originate from either the front-panel READOUT switch or from an external controller. The startup logic is located at the left of Schematic 10, a few inches down from the top. Darlington transistor Q2414 ties to the front-panel switch. When its base is high (switch off), its collector pulls down the inputs to U2416B and A (below), disabling the gates. When the switch is turned on, the transistor cuts off, and the inputs go high to enable the two gates.

When enabled, U2416A and B accept signals from an external controller ($\overline{\text{GRATICULE}}$ $\overline{\text{SHUTDOWN}}$, TRIGGER, ENABLE), and from the $\overline{\text{HOLDOFF}}$ signal. $\overline{\text{HOLDOFF}}$ is high whenever the sweep from the horizontal plug-in is running. ENABLE and TRIGGER are normally high, with TRIGGER momentarily pulled low by the controller to initiate a graticule cycle. The generator can be disabled with an external controller by pulling $\overline{\text{GRATICULE}}$ $\overline{\text{SHUTDOWN}}$ low.

Assume that the R7912 is operating in a repetitive-sweep mode without an external controller. In this mode, $\overline{\text{HOLDOFF}}$ goes low during horizontal retrace. When the graticule is enabled from the front-panel switch, pin 13 of

U2416A is high. Pin 2 is normally high (unless an external controller pulls it down), and pin 1 goes high as the $\overline{\text{HOLDOFF}}$ signal is inverted by U2418C. The pin-12 output of U2416A goes low, and that signal causes pin 8 of U2416C to go high. The high transition is passed to an edge detector composed of U2458B and U2460C. The R-C network provides a narrow, negative-going pulse at the output of U2460C. This pulse sets the R-S flip-flop formed by U2460A and B, which starts the Graticule Generator. A detailed timing diagram is given in Fig. 3-15. It will be helpful in the following discussion.

Vertical Ramp Clock. The vertical ramp clock signal (13.89 kilohertz - derived from the 5-megahertz Sync Generator clock) is running all the time, but it doesn't do very much until the startup flip-flop (U2460A and B) is set. At that time, pin 3 of U2460A goes low. Following the signal down and to the right, notice that it drives Q2482 through U2426A and issues $\overline{\text{Z AXIS INHIBIT}}$, blanking the writing beam as far as the horontal plug-in i concerned.

It also pulls up the emitter of Q2484 and issues SWEEP LOCKOUT to the horizontal plug-in, preventing further sweeps. D flip-flop U2478B disables the SWEEP LOCKOUT signal if the sweep rate is set faster than 5 microseconds/division. At high sweep speeds the relatively slow graticule generation period interferes with the display, so the sweep is allowed to run by setting U2478B.

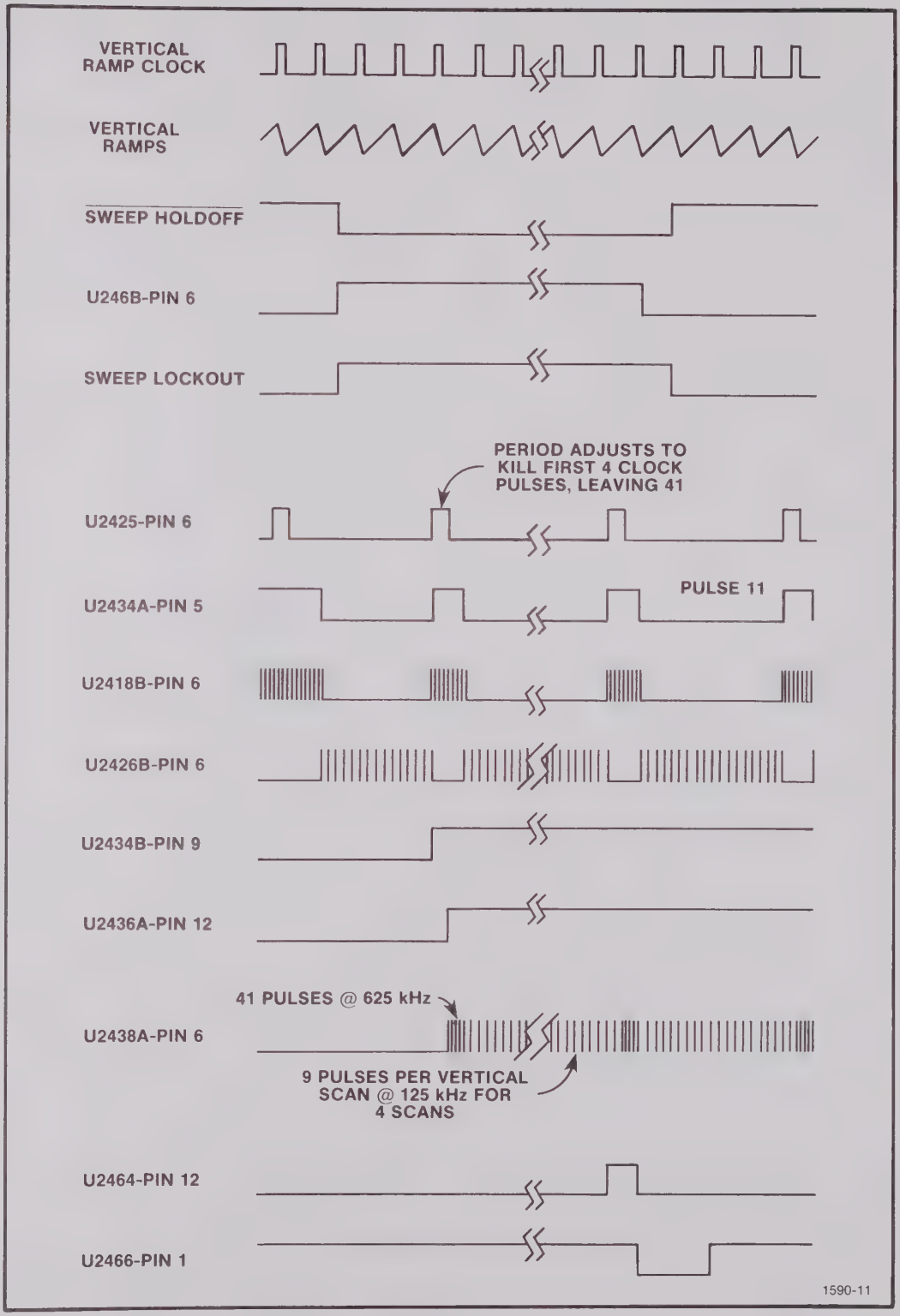


Fig. 3-15. Graticule Generator timing.

Look back to the startup flip-flop and to U2460D below it. The low start signal is also passed through that gate, setting the D input of U2478A high and releasing the set input to U2434A, up above. The pin 6 output of the startup flip-flop places a high on the D input of U2434 as well.

Generating a Graticule. Remember that an entire vertical line of graticule dots must be produced for each vertical ramp clock cycle. If a major division line is being generated, 41 dots are required. If a minor division line is being generated, only nine dots are needed. Figure 3-16 describes the operation.

Each falling edge of the clock signal from U2412 (top left) fires the vertical ramp clock one-shot, U2419. Its pin 6 output goes high, and the edge detector composed of U2432A and B produces a low going pulse at its output. This occurs with every vertical ramp clock pulse, but the D input to U2434A is tied to the output of one-shot U2425. Driven by a divide-by-five counter, U2425 only fires on every fifth vertical ramp clock pulse. The startup signal occurs at a random time relative to the vertical ramp clock, and precise synchronization is necessary.

The first vertical ramp clock following the startup signal clocks U2434A. Remember that this flip-flop was set at the beginning of the cycle. Since the D input of U2434A is high only on every fifth clock pulse, this first clock effectively clears U2434A. Its pin 5 output goes low.

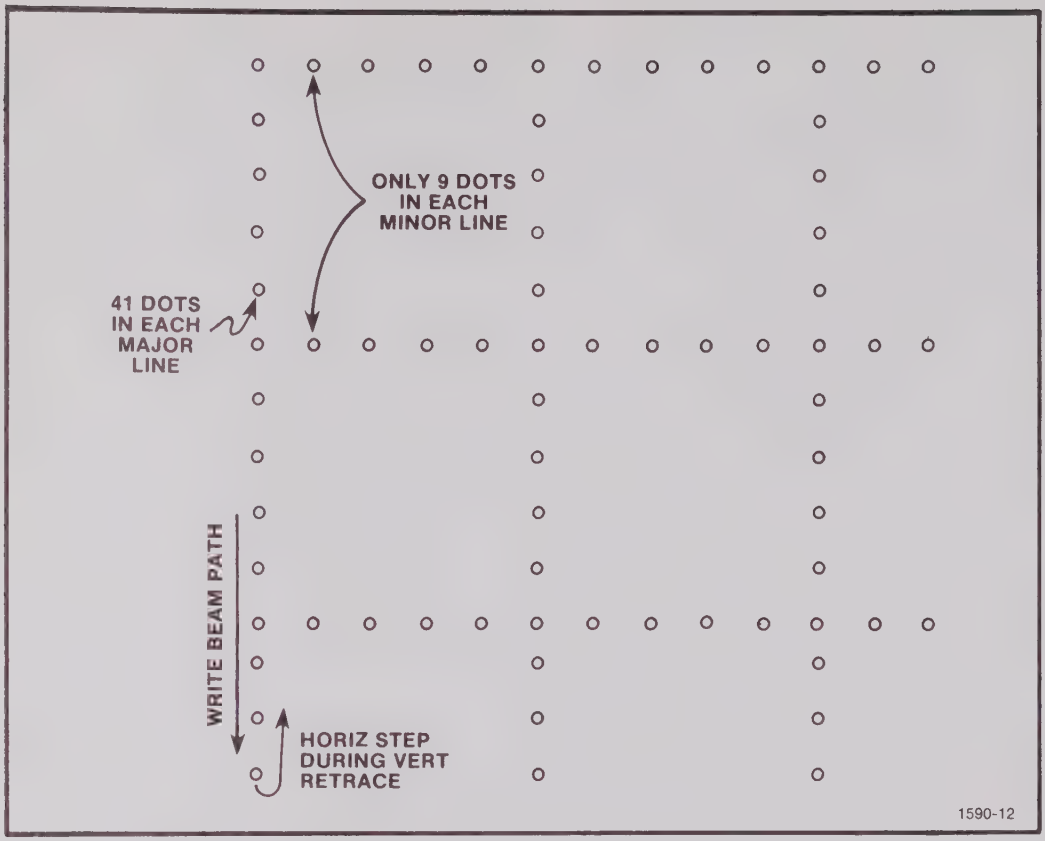


Fig. 3-16. Generating a graticule.

Nothing more happens until the fifth clock pulse fires one-shot U2425. Then the D input to U2434A goes high, and the next vertical ramp clock signal sets the flip-flop. The rising edge at pin 5 of U2434A clocks U2434B, and its pin 9 output goes high, setting the J input of J-K flip-flop U2436A high.

When one-shot U2425 times out, the falling edge of its pin 6 output clocks U2436A, setting that flip-flop's pin 12 high. Notice that the pin 1 output of U2425 returns high simultaneously, and both inputs to NAND gate U2432D are high. Through U2432C, this gate enables one shot U2438. The one-shot drives the Z axis circuitry - its period deter-

mines the basic dot size.

Two gates drive U2438; U2418B and U2426B. U2418B has a 625 kilohertz clock signal applied to its pin 5 input, while U2426B has 125 kilohertz (divided down by U2430) applied to its pin 5 input. Flip-flop U2434A turns each gate on alternately as it is set and cleared (refer to the timing diagram).

At the start of a graticule cycle, a full line of 41 graticule dots must be produced, then four lines of 9 dots, then another full 41 dot line, and so on. Full lines are produced when U2418B is driving 625 kilohertz pulses into U2438 (while that one-shot is enabled by U2432D) and lines with 9 dots are produced when U2462B is driving 125 kilohertz pulses into the one-shot. Notice that the 625 kilohertz gate can be disabled with a strap option, P2435, to produce a vertex-dot only graticule.

The period of one-shot U2425B is adjustable, and when adjusted correctly, it delays the enable signal to U2438 by a time equal to four 625 kilohertz clock pulses. Inspection of the counters reveals that 45 pulses are available during the vertical scan period, but only 41 are needed. The period of U2425B allows the extra pulses to be ignored, and the delay allows time for vertical retrace, as well.

Remember that a horizontal step occurs during each vertical retrace, moving the writing beam across the target in increments. The number of horizontal steps taken is monitored by U2464 (about four inches down from the top right corner). When this counter reaches a count of ten (indicating eleven horizontal steps have occurred, since the first count is ignored) its pin 12 output fires one-shot U2466, generating a reset pulse for the Graticule Generator. The mainframe channel switch is reset to handle the plug-in signals, the Z-axis control line is released, and the sweep unlocked. The Graticule Generator now awaits another trigger signal.

Sync Generator

Introduction

The Sync Generator card generates vertical and horizontal synchronizing pulses for control of the X and Y Ramp Generator timing (via the Data Address Counter) and for addition to the video information produced by the Video Processor circuits. The sync format is compatible with standard video monitors. An example of the -COMPOSITE SYNC output waveform including the vertical sync "packet" is shown in Fig. 3-17. You may recognize this waveform as an inverted version of a standard synchronizing waveform.

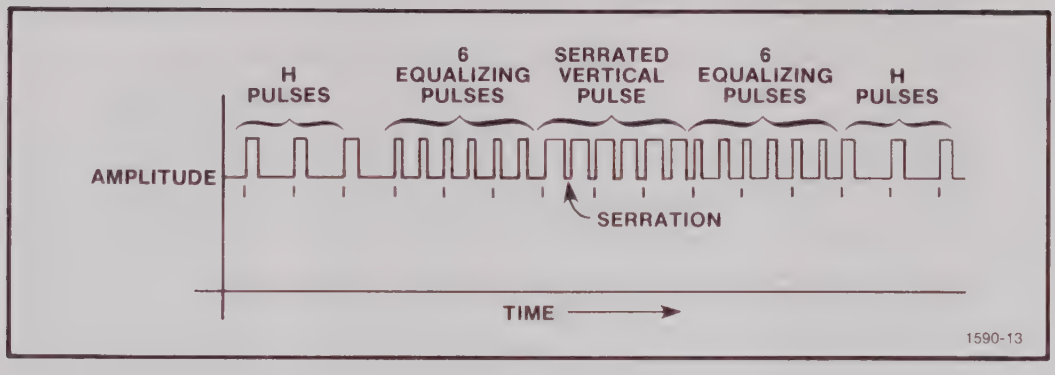


Fig. 3-17. The vertical sync packet.

In addition to the -COMPOSITE SYNC signal, the Sync Generator produces 5-megahertz clock signals for the R7912 Calibrator, the Graticule Generator, and the Data Address Counter circuits. Blanking signals and special synchronizing pulses for the Data Address Counters are also produced. The number of horizontal scan lines per frame can be changed to conform to most scanning standards in common use. A simple program change (I.C. replacement) is all that is usually required. Schematic 11 describes the Sync Generator circuit.

Description

Clock Oscillators. Lets start with the clock signals. At the top of Schematic 11, about three inches to the right of center, is a dual voltage-controlled oscillator, U2730. The top portion is crystal controlled at 5 megahertz and provides necessary timing signals when no external synchron-

izing signal is available. The lower oscillator is active when the external sync is available. To the left of the oscillator is a phase comparator (U2716) driving an op-amp (U2725). This circuit is the same as that used to control the X and Y Ramp Generators. The phase comparator provides a correction voltage at pins 2 and 13 if the horizontal portion of the external sync signal doesn't exactly synchronize with the divided-down output of the clock oscillator. The correction voltage drives op-amp U2725, which in turn drives the voltage-controlled oscillator, correcting the operating frequency.

The three gates to the right of the oscillators (U2732A, B, and D) select which oscillator output will be used. If external sync is available, U2732B is enabled and the lower oscillator is used. The crystal-controlled oscillator is used if no external sync is available, or if the R7912 is operating in Digital mode.

External Sync. The external sync signals enter the schematic at the upper left corner. L2701 forms a loop-through path so that other instruments may use the signal. The sync information is tapped off and capacitively coupled to U2706, where the signals are converted to TTL levels. The sync format at this point is the same as that shown in Fig. 3-17. One-shot U2708 provides a leading-edge-sensitive output pulse for each rising edge of the sync waveform.

U2710 has a period of about 1.5 cycles of the sync equalizing pulses. It fires on the falling edge of the pin 1 output of U2708. With this period, U2710 serves as a sync separator. Horizontal sync pulses pass through U2712A to the phase comparator, but are blocked by U2712B. The only output from U2712B consists of the first detected equalizing pulse in the sync waveform. This pulse is used to synchronize the countdown circuits to be discussed a little later.

The external horizontal sync pulses also drive retriggerable one-shot U2714 (below the comparator). Its period is greater than the horizontal sync period, so its pin 8 output stays high when sync is present. This steady high is used to switch the output gates for the 5-megahertz clock signal (U2732B and D), selecting the lower oscillator.

Clock Dividers. The 5 megahertz clock signal is divided down by a series of programmable dividers. The first two, U2741 and U2745, are 'programmed' by U2743 to divide by 159 for NTSC standards. European users require a different program I.C. to provide a divide-by-160 program. The program is simply a hard-wired circuit connecting the appropriate counter inputs to +4.9 volts or to ground, as required. The connections are made in an I.C. package for convenient change.

The output of the first two dividers is a 31.4685-kilohertz positive-going pulse. U2747B inverts the signal and applies it to the remaining counters for further division, and to one-shot U2749. U2749 has a one-microsecond period, and provides the familiar "front porch" for the sync waveform.

The output of U2749 drives flip-flop U2751A, which is connected as a divide-by-two counter. The resulting 15.750-kilohertz waveform is used as the comparison waveform by phase comparator U2716.

The remaining counters divide the 31.5-kilohertz signal by 525 (625 for European standards), producing a 60-hertz output (50 hertz for European standards) for the vertical sync circuits. One-shot U2762 and flip-flop U2751B constitute a synchronizer for the counter circuits. If the first equalizing pulse in the vertical blanking interval doesn't coincide with the divided-down 60 (or 50) hertz counter output, U2747C delivers a reset pulse to the counter chain. This reset establishes synchronization during the first frame of external sync.

Generating the Sync Waveform. A timing diagram describing horizontal sync generation is shown in Fig. 3-18. Horizontal sync pulses are derived from the 31.5-kilohertz clock from pin 1 of one-shot U2749, and from the 15.75-kilohertz clock at pin 6 of flip-flop U2751A. These two signals drive a one-shot at the bottom right of your schematic,

U2786.

The narrow 31.5-kilohertz pulses are gated by the wider 15.750-kilohertz pulses, producing a 15.750-kilohertz string consisting of every other 31.5-kilohertz horizontal sync pulse. Horizontal blanking pulses are produced at the same time by the complementary output of U2786. U2738D just above produces a horizontal pulse delayed by the period of U2749 (back up at center schematic), about 1 microsecond. This delayed pulse is used by the Data Address Counter circuit.

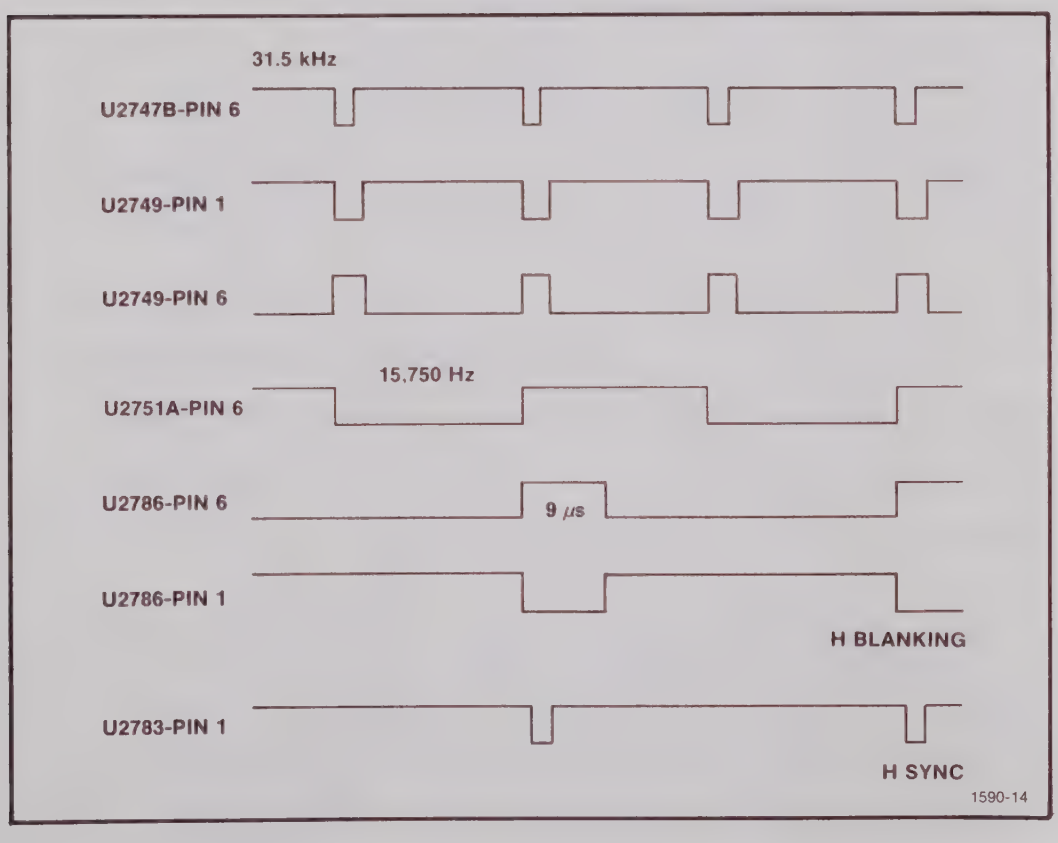


Fig. 3-18. Horizontal sync generator timing.

Vertical sync generation begins when the 60 hertz (50 hertz for Europe) output of the counter chain goes high. The high is inverted by U2747A (to the left of the lowest counter) and applied to U2769A and one-shot U2771 down below. The low sets flip-flop U2769A and fires one-shot U2771. The one shot issues a blanking pulse via U2773C at the bottom of your schematic. The blanking pulse period is slightly longer than the entire vertical blanking interval, assuring sufficient ramp setup time following retrace.

Figure 3-19 is a detailed timing diagram of the vertical sync generation process. It will be helpful during this discussion.

The now set flip-flop (U2769A, pin 5) turns off transistor Q2780 (changing the time constant of one-shot U2783), releases the clear inputs to U2767A and B, and removes the reset signal from divide-by-six counter U2765. Since U2767A is cleared, its pin 6 output is high, and NAND gate U2773 has both inputs high. Its output goes low, turning Q2775 on and setting the time constant of U2783 to generate equalizing pulses.

The equalizing pulses are generated by U2783 (pin 1) at the 31.5-kilohertz rate, under control of the pin 5 input. Divide-by-six counter U2765 counts up to six 31.5-kilohertz pulses at its pin 14 input, then clocks U2767A through U2764D. The counter resets itself at the sixth count from the pin 11 output of U2764D through U2767C. The

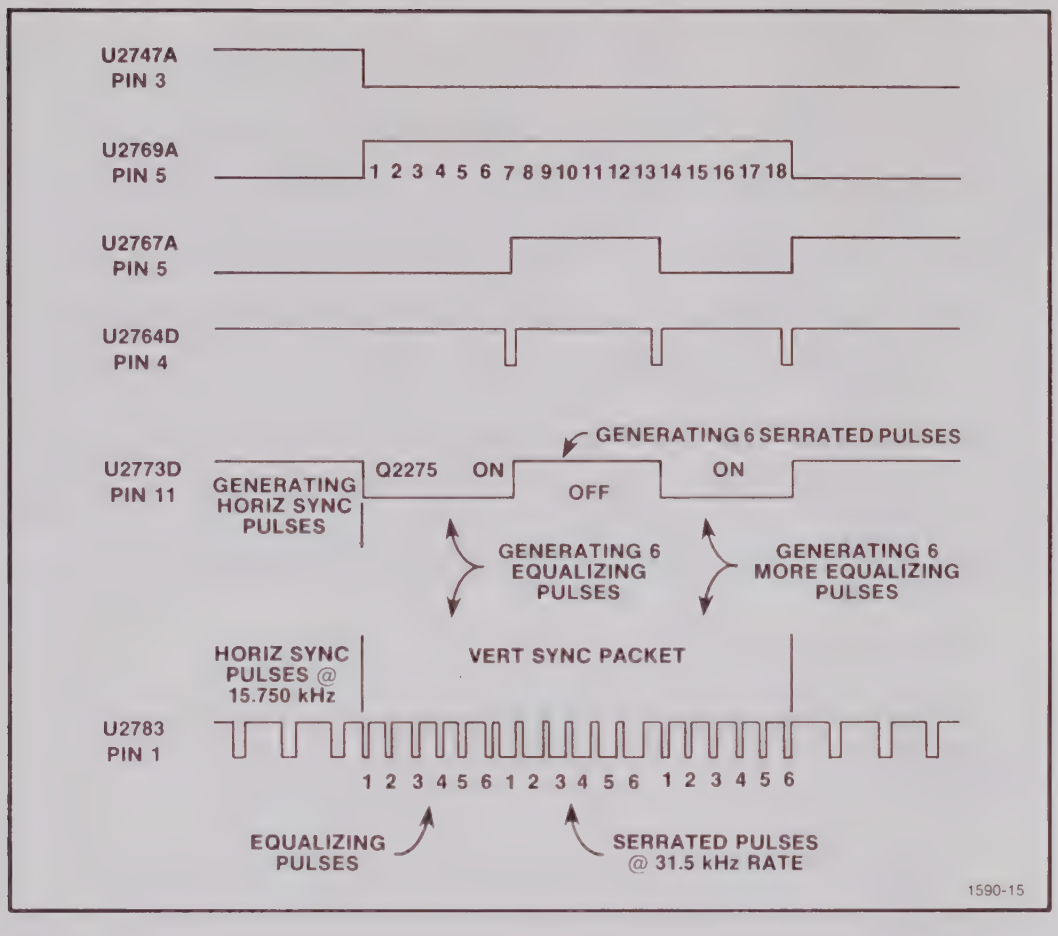


Fig. 3-19. Vertical sync generator timing.

two D flip-flops (U2767A and B) are connected as a divide-by-three counter, and they count the three six-pulse components of the vertical sync packet. The first six equalizing pulses have been generated, and the divide-by-three counter has been incremented one count. The pin 6 output of U2767A goes low (not affecting the positive-edge sensitive input of U2767B) and turns off NAND gate U2773D. The output of U2773D turns off Q2775, and the time constant of one-shot U2783 is increased. The circuit is now prepared to generate the serrated pulse portion of the vertical sync packet.

The divide-by-six counter again counts six 31.5-kilohertz pulses and one-shot U2783 provides the proper pulse-width for the serrated waveform. At the count of six the counter resets itself, and U2767A is clocked again. Its D input is now low, so its pin 6 output returns high, clocking U2767B. The pin 6 output also turns NAND gate U2773D back on, resetting the period of U2783 for another series of equalizing pulses.

Our divide-by-three counter has now incremented to a two count, indicating that two six-pulse packets have been produced. The divide-by-six counter (U2765) counts six more equalizing pulses, then clocks U2767A for the third time. Its pin 1 output goes high and, since pin 9 of U2767B is high, enables NAND gate U2764A. The output of U2764A clears U2769A and signals the end of the vertical sync interval. The pin 5 output of U2769A goes low and turns Q2780 on, setting the period of U2783 for horizontal sync pulse generation. The low at pin 5 also goes back to clear both flip-flops in the divide-by-three counter, and to reset the divide-by-six counter. The clear signal is held until the next vertical sync interval occurs to reset U2769A, starting the cycle over again.

Data Address Counters

Introduction

The Data Address Counter circuits control storage of waveform data in a local semiconductor memory when the R7912 is operating in Digital mode. Their operation is analogous to the Sync Generator circuits that control target data during TV mode operation.

You recall that the Digital mode scanning format consists of a series of 512 vertical lines, each scanned in 512 steps from top to bottom. The step ramps generated by the X and Y Ramp Generators direct the reading beam in this fashion under control of counters located on the Data Address Counter circuit card. The Y address counters are incremented by the 5 megahertz clock signal (originating on the Sync Generator card) and control the 512 vertical steps taken by the read beam. The X address counters are incremented each time the Y address counters reach maximum count (indicating a vertical scan is completed), stepping the beam over one position on the target.

Each time the horizontal address counters are incremented, the current counter value (which locates the horizontal position of the read beam on the target) is automatically loaded into the R7912 memory. Any video information that is discovered in the following vertical scan causes a video pulse to be generated by the Video Processor. This

pulse causes the current value of the vertical address counters to be loaded into memory. If several video pulses are produced on a given vertical scan, a vertical address for each pulse will be loaded into memory, all following one horizontal address for the scan. Figure 3-20 should clarify the process.

Overview

Let's look at some of the more apparent blocks of circuitry on Schematic 12. At schematic center are three cascaded binary counters, U2835, U2838, and U2841. This counter set constitutes the vertical address counter, and it is clocked by a gated version of the 5 megahertz signal.

Just below the vertical address counters are three more binary counters. As you might expect, these constitute the horizontal address counters. They are clocked at the end of each vertical scan by a signal from the vertical address counters. Notice that the outputs of both sets of counters go over to the right edge of the schematic to a set of data selectors, U2844, U2850, and U2854. Depending on the state of their common select lines, these data selectors accept either the vertical or the horizontal address counter value and transfer it to a 12-bit latch consisting of U2847, U2852, and U2857. Data in the latch is available for storage in memory.

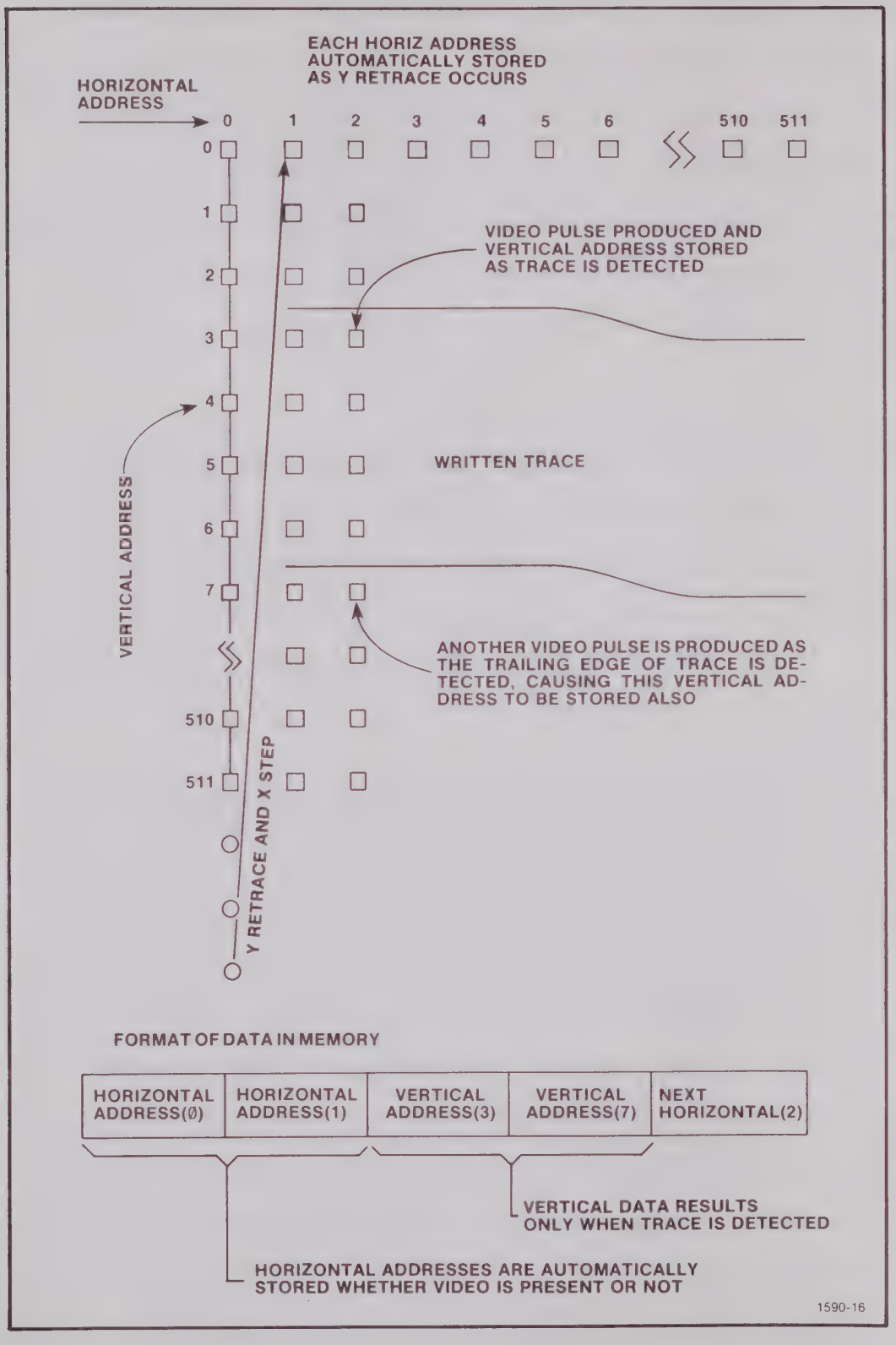


Fig. 3-20. Loading target data into memory.

The circuitry at the top of the schematic, in general, provides a $\overline{\text{STROBE}}$ pulse to the memory, either for storing a horizontal address, or when video is detected, a vertical address. It also provides clock gating to delay the vertical ramp for 1.6 microseconds whenever video is detected. As mentioned in previous discussions, the delay allows time for the semiconductor memory to store the vertical address of the detected video.

The block of components located to the left of each counter set produces control signals at certain count values. The top set of components for example (U2820, U2825, U2828, etc.), provides an output signal at the 512 count of the vertical address counters to indicate the end of scan, and additional signals at counts 520 and 568 for blanking purposes. The lower set (U2860, U2865, U2877, etc.) provides the same sort of signals for the horizontal address counters.

In the lower right corner of the schematic is another data selector, U2884. This device selects control signals from either the Sync Generator (TV mode only) or from the Data Address Counter (Digital mode only) under control of the $\overline{\text{DIGITAL}}$/DISPLAY line.

Description

Vertical Address Counters. The vertical address counters are incremented at a 5-megahertz rate by clock signals at pin 5 of U2814B (top left of schematic). This gate is enabled when the $\overline{\text{DIGITAL}}$/DISPLAY line is low, indicating Digital mode operation, through inverter U2814A. The now inverted clock is applied to flip-flop U2816A, but unless video is detected, the D input remains high and the flip-flop remains "set".

The clock signal goes on through inverters U2817E and D, is delayed slightly by C2817, and drives the pin 10 input of NAND gate U2814C. The pin 9 input is high (since U2816A is normally in the set state), so the clock signal is passed by the gate. The signal is sent to the Y Ramp Generator as $\overline{\text{Y TRIGGER}}$ to increment the step ramp produced there. The clock signal also connects to the clock inputs of the vertical address counters, U2835, U2838, and U2841. These counters continue to increment until video is detected, or until they reach maximum count (568 in this case).

Storing Vertical Addresses . When video is detected, the Video Processor produces an output pulse. This pulse enters the Data Address Counter schematic at the upper left corner at the pin 5 input of U2801B.

Assuming that the vertical address counters are currently somewhere between a 0 and a 511 count, the pin 4 input will also be high. The video pulse is passed to U2801D, then applied to one-shot U2811. This one-shot has a 1.6-microsecond period. Its 0 output goes low, setting the D input to flip-flop U2816A low. The next clock pulse clocks the low through U2816A to the 1 output, simultaneously disabling NAND gate U2814C and firing one-shot U2818. The disabled gate interrupts the clock signal to the vertical address counters, preventing them from incrementing past the point at which video was detected. The counter value at this time represents the vertical address of the detected video. Data selectors U2844, U2850, and U2854 transfer this value to the D inputs of the output latches.

As one-shot U2818 fires, its 0 output goes low. This low is inverted by buffers U2817A, B, and C and applied as a high to the gate inputs of the output latches, U2487, U2852, and U2857. The 1 outputs of these latches follow the D inputs as long as the gate inputs are held high, so the counter value is transferred to the R7912 memory inputs. The 1 output of one-shot U2818 delivers a $\overline{\text{STROBE}}$ pulse to the memory, causing it to store the vertical address.

After the 1.6-microsecond period of U2811 passes, it returns to its stable state. The next 5-megahertz clock pulse returns flip-flop U2816 to its set state, and NAND

gate U2814C is again enabled. The vertical address counters begin incrementing, and the reading beam continues its vertical scan.

Vertical Blanking. When the vertical address counters reach a 512 count, the reading beam is blanked and preparations made for retrace. The 512 count is detected by a one-shot (U2828) connected to a vertical "program" I.C. (U2820). This "program" is simply a hard-wired set of jumpers housed in an easily changed I. C. package. The 512 count line enters U2820 at pin 7. It is hard-wired directly over to pin 5, where it fires one-shot U2828. The other lines are similarly wired to detect other count values.

A 512 count causes U2828 to fire, and its pin 1 output goes low. Follow the signal to the R-S flip-flop formed by U2830A and B. This flip-flop sets, and its pin 6 output goes low. The low signal is passed through U2833B and U2833A down to U2830C. The resulting high goes to the data selector at the right (U2884) where it becomes a video blanking signal for the Video Processor. The high from U2830C is also inverted by U2805B and sent back up to the top left corner of the schematic to disable U2801B. No video can pass through this gate until retrace is complete.

Now look back to one-shot U2828. Its pin 1 output also increments the horizontal address counters down below -- U2867, U2869, and U2871.

The vertical address counters are allowed to continue counting. At a 520 count, both inputs of U2805A (a NAND gate to the right of U2820 - the large program I. C.) go high. Its output goes low, setting the R-S flip-flop formed by U2833C and D. Pin 8 of U2833C goes low, and the signal is taken down to the data selector at bottom right, U2884. It emerges at pin 4 of U2884 as a $\overline{\text{YREF}}$ signal, synchronizing the vertical retrace timing of the Y Ramp Generator.

Storing a Horizontal Address. The occurrence of vertical retrace causes the Y Ramp Generator to produce a signal called $\overline{\text{Y RETRACE GATE}}$. It enters our schematic at the upper left corner at pin 2 of U2801A. The resulting high from this gate is applied to one-shot U2803, but let's return to that in a moment.

Follow the other line from pin 3 of U2803 over to the right edge of the schematic and down to the SELect inputs of data selectors U2844, U2850, and U2854. With the SELect line high, these devices accept data from their 1 inputs only, or from the horizontal address counters. In other words, the occurrence of vertical retrace switches the data selectors from the vertical to the horizontal address counters. Now back up to one-shot U2803.

The output of U2801A fires U2803, which, in turn, fires U2807 through NAND gate U2805C. This gate is enabled (pin 10 high) as long as horizontal retrace is not in progress. The pin 10 input comes from the bottom of the schematic at pin 3 of inverter U2874A. We'll assume at this point that the horizontal address is currently somewhere between 0 and 511, so U2805C is enabled. When U2807 fires, its pin 1 output fires 1.6-microsecond one-shot U2811. Just as for the vertical address counter description, the one-shot stops the 5-megahertz clock, enables the output latches, and issues a $\overline{\text{STROBE}}$ signal to the memory, causing the horizontal address (the data selectors are now "looking" at the horizontal counter outputs) to be stored in memory.

Horizontal addresses are modified slightly so that they can be distinguished from vertical addresses in memory. This is accomplished by setting bit 9 (the pin 15 output of latch U2857) high for all horizontal addresses. Notice that the D input for that latch comes from the SELect lines of the data selectors. Whenever the horizontal counter is selected, the SELect line is high.

The vertical address counters are still counting through all of this blanking and horizontal storage procedure, providing sufficient delay for all the operations. When a vertical count of 568 is reached, U2822A (again, near vertical program I. C. U2820) has all inputs high. Its output fires one-shot U2825, which delivers a reset pulse

to the vertical address counters. Notice that the reset signal also goes over to the left to enable NAND gate U2830D. Its pin 11 output goes low, resetting the R-S flip-flops formed by U2833C-D and U2830A-B. The pin 1 output of the reset one-shot (U2825) drives through U2833B and A down to the lower data selector to extend the video blanking period slightly. This signal also delays the enabling of video pulse gate U2801 for 500 nanoseconds or so during the counter reset time.

Horizontal Blanking. When the horizontal counter increments to a 512 count, retrace and blanking operations begin. The horizontal counter circuits are essentially identical to the vertical circuits, but slightly different count values are "programmed" into horizontal program I. C. U2860.

As before, blanking starts with the 512 count, and extends until slightly after a 538 count. The 520 count issues $\overline{\text{X REF}}$ to synchronize horizontal retrace on the X Ramp Generator board. The 538 count is detected by U2822B, firing one-shot U2865. The 1 output of U2865 resets the horizontal counters and R-S flip-flops just as for the vertical counter circuits.

Memory Control and Memory Array

(Option 14)

Introduction

The Memory Control and Memory Array circuits are combined on one plug-in circuit card located behind the swing-out front panel of the R7912. The memory provides storage for up to 4096 10-bit words of waveform data. Waveform information consists of the horizontal and vertical addresses of any video detected on the target. The contents of memory are made available to an external device through the 104-pin connector on the R7912 rear panel.

Memory control consists of providing proper address information, read/write timing, and provisions for external control of the reading process. A special function of the control circuits is to monitor the number of vertical addresses associated with a given horizontal address. Since the number of vertical addresses resulting from any scan depends on the video detected, a potentially large number of addresses could be stored. Noise and target defects can contribute to this number. The normal acquired waveform will have from one to several valid vertical addresses per horizontal address, so the control circuits limit storage of verticals to an average of seven per horizontal. This prevents premature memory overflow and makes more efficient use of the available memory space.

Memory Array

The Memory Array (Schematic 14) consists of 40 integrated circuit memory chips arranged in a 10X4 matrix. Each chip has a 1024-bit storage capacity, and the arrangement provides storage for up to 4096 10-bit words. Referring to the schematic, notice that the memory I.C.s are laid out in four columns, with ten I.C.s in each column. Each column of devices is enabled with a $\overline{\text{CHIP SELECT}}$ signal from the Memory Control address counters. All chips have their address lines (A0-A9) paralleled.

The first column stores the first 1024 10-bit words of waveform data. This is accomplished by placing an address on lines A0-A9 and asserting the $\overline{\text{CHIP SELECT}}$ line for that column (and only that column). The $\overline{\text{CHIP SELECT}}$ lines for each column are labeled at the top of the schematic. The second set of 1024 words (addresses from 1024 to 2047) are stored in the second column by asserting the address and the second $\overline{\text{CHIP SELECT}}$ line. Storage continues in this way until the end of waveform data is encountered, or until the memory space is exhausted.

Each bit of data enters its memory chip via the D-in input (pin 11). Storage is controlled by the R/$\overline{\text{W}}$ input (pin 3). If this input is high when a valid address is applied (READ Mode), the memory places the contents of the addressed memory cell on its D-out line (pin 12). In this memory read operation, no data is stored or changed in the

memory chip. Previously stored data is simply presented for examination. If the R/$\overline{W}$ input is pulled low (WRITE Mode), any data present at the D-in input is stored at the address asserted on the address lines (A0-A9).

Memory Control

Schematic 13 describes the Memory Control circuits. The bottom half of the schematic is devoted to memory address counters U2961 through U2967, line counters U2945 through U2949, and comparators U2951 through U2955. Notice at the bottom right a 4-line to 8-line decoder, U2975. This device decodes the upper 4 bits of the memory address and asserts the appropriate $\overline{\text{CHIP SELECT}}$ line. The present R7912 uses only the first four lines. The remainder are reserved for future expansion.

Storing Waveform Data. At the upper left corner of schematic 13 are some signal input lines. $\overline{\text{SWP GATE}}$ is a low-going signal that occurs whenever the horizontal sweep is running. $\overline{\text{LOAD COMMAND}}$ is a signal from an external controller that causes a memory loading cycle to start. The $\overline{\text{LOAD COMMAND}}$ is required during repetitive-sweep mode operation only. In single-sweep mode, the sweep trigger automatically starts a load cycle. For now, let's assume the R7912 is in repetitive-sweep mode, and that the $\overline{\text{LOAD COMMAND}}$ signal has not been issued yet.

The R-S flip-flop formed by U2912A and D is set in this condition. $\overline{\text{SWP GATE}}$ pulses are occurring at the pin 3 input to one-shot U2902, but the enabling pin 5 input is held low. To justify that, follow the pin 11 output of U2912D (now low) down to the input of NAND gate U2912B. The low signal disables the gate, and its output is high. Since the R7912 is not in single sweep mode, Q2905 is off, and its collector is high. That leaves both inputs to U2912C high, resulting in a low disabling signal for one-shot U2902.

When a $\overline{\text{LOAD COMMAND}}$ occurs, the R-S flip-flop is set, and pin 11 of U2912D goes high. The high enables U2912B (we will show that its pin 4 input is also high a little later) and its pin 6 output, inverted by U2912C, enables the one-shot. The next occurrence of $\overline{\text{SWP GATE}}$ fires the one-shot. As U2902 fires, its pin 6 output goes high, issuing $\overline{\text{LOAD DELAY}}$ through U2918D. This signal was used to hold off read beam unblanking for 100 microseconds in early instruments. The high pin 6 output of U2902 is also applied to one-shot U2916. The trailing edge of the 100 microsecond period of U2902 fires U2916.

Notice that the low-going pin 1 output of the first one-shot (U2902) immediately resets the R-S flip-flop that was set by $\overline{\text{LOAD COMMAND}}$. The reset flip-flop disables U2902, preventing further $\overline{\text{SWP GATE}}$ pulses from firing the one-shot. If the R7912 had been in single-sweep mode, Q2905

would be on, and its collector would pull down the pin 10 input of U2912C. The output of that gate would enable one-shot U2902, and a sweep trigger (which results in $\overline{\text{SWP GATE}}$) would fire it. Thus, in single-sweep mode, a $\overline{\text{LOAD COMMAND}}$ is not necessary.

Let's return to one-shot U2916. This device was fired by the trailing edge of the pulse from U2902. Its pin 6 output goes high for a short time, then returns low. The falling edge triggers one-shot U2923. Pin 6 of U2923 issues $\overline{\text{H TRANSFER}}$ through U2982D. The $\overline{\text{H TRANSFER}}$ signal causes the Data Address Counters (Schematic 12) to inhibit the $\overline{\text{X STEP}}$ signal and issue $\overline{\text{STROBE}}$. The signal also forces this first data word to be a horizontal address. The pin 1 output of U2923 goes low. The signal is inverted by U2919A and used to clear the memory address counters at the bottom of the schematic.

Notice that the pin 6 output of U2916 does more than just trigger U2923. The rising edge of this signal is directed through NAND gate U2918B (to the right on the schematic) to set the R-S flip-flop formed by U2928C and B. This is the LOAD flip-flop, and when set, its pin 4 output goes low, issuing LOAD ENABLE through U2906C. The low is passed back to the left edge of the diagram to disable both U2912B (preventing further $\overline{\text{LOAD COMMAND}}$ signals) and U2918C (preventing a READ START signal from interrupting the loading process). The low signal enables one-shot U2939

through U2933D, allowing $\overline{\text{STROBE}}$ signals to trigger the device. U2933A is also affected, and its pin 3 output goes high, enabling NAND gate U2933C. This gate asserts $\overline{\text{WRITE}}$ to the memory when data is to be stored.

Look back up to the LOAD flip-flop again (U2928B and C). Its pin 10 output is now high, and the signal enables U2926A and U2928A down below. The high signal also enables U2937A, off to the left of the diagram.

Storing a Horizontal. With all the preparations out of the way, let's store some information. Issuing $\overline{\text{H TRANSFER}}$ forces the first word to be a horizontal address. Horizontal addresses are a special case for the Memory Control circuits, and each occurrence is counted. When 512 horizontals have been stored, the horizontal counter circuits terminate the storing process. This first horizontal must be counted as the 0th, however, because the counters run from 0 to 511. $\overline{\text{H TRANSFER}}$ accomplishes this feat by inhibiting $\overline{\text{X STEP}}$ when $\overline{\text{STROBE}}$ is issued. $\overline{\text{X STEP}}$ is a flag signal indicating that the value to be stored is a horizontal. Inhibiting $\overline{\text{X STEP}}$ causes the horizontal counters to ignore this first horizontal, so the count remains at 0. $\overline{\text{STROBE}}$ causes the horizontal address to be stored in memory at address 0001. Let's look at $\overline{\text{STROBE}}$ with this preliminary information in mind.

When the $\overline{\text{STROBE}}$ signal arrives from the Data Address Counter circuits, it is inverted by U2937A (at left center of the schematic) and passed through U2937B. The pin 5 input to this gate is tied high through R2937, and is not otherwise used in the R7912. The pin 6 output of U2937B fires one-shot U2939. The output at pin 6 increments memory address counter U2961 to a count of 1.

When U2939 times out, the address inputs to the memory chips have had ample time to stablilize. The falling edge of the one-shot output fires U2942. The pin 6 output activates U2933C (enabled by the LOAD flip-flop as discussed previously) and its pin 8 output asserts $\overline{\text{WRITE}}$ to the addressed memory chips. Horizontal data placed on the memory data lines by the Data Address Counter circuits is then stored in memory.

All horizontal addresses occurring after the first one must be counted by horizontal line counters U2945, U2947, and U2949. The $\overline{\text{X STEP}}$ signal serves to increment the counters through U2926A and B.

When the 512th horizontal is detected at pin 9 of counter U2949, the signal is inverted by U2906E, U2918A, and U2906D, then used to reset the LOAD flip-flop. The loading operation is terminated at that point. When pin 4 of U2928B goes high, U2933B is enabled. Its pin 6 output, inverted by U2906A, clears the horizontal counters.

Storing Verticals. So far we have discussed horizontal address storage only. Between horizontals, however, a variable number of vertical addresses may occur. You recall that vertical addresses result from video information on the Scan Converter target. The amount of video information detected on a given scan determines the number of vertical addresses that occur.

Vertical storage also requires a $\overline{\text{STROBE}}$ pulse. The $\overline{\text{X STEP}}$ pulse that accompanied $\overline{\text{STROBE}}$ during horizontal storage is absent, however. Without $\overline{\text{X STEP}}$, the horizontal counters do not increment; only the memory address counters are affected.

Comparators U2951, U2953, and U2955 compare the current horizontal count with the upper 12 bits of the memory address counters. The three low-order bits not compared (pins 3, 2, and 6 of U2961) allow the memory address counter to increment only seven counts beyond the last horizontal value stored, thereby limiting the maximum number of vertical values stored per horizontal address.

If the number of verticals reaches eight, pin 7 of U2955 goes high (indicating that too many verticals are about to be stored) enabling U2928A. The pin 1 output of U2928A issues $\overline{\text{DATA INHIBIT}}$, which disables the $\overline{\text{STROBE}}$ one-shot on the Data Address Counter card. No more data can be stored until the next horizontal occurs ($\overline{\text{X STEP}}$). At that time, the comparators release U2928A and $\overline{\text{DATA INHIBIT}}$.

Reading Waveform Data. Reading the contents of the R7912 memory begins with a $\overline{\text{READ START}}$ command. The signal enters Diagram 13 at the upper left edge, is inverted by U2906B and applied to U2918. This gate is enabled because the LOAD flip-flop is not set (its output at pin 4 of U2928B is high). The resulting low at pin 8 of U2918C clears the memory address counters through U2919A, and sets another R-S flip-flop, U2919B and C. This is the READ flip-flop, and it remains set throughout the read cycle. Pin 8 of U2919C goes low, issuing READ ENABLE through U2962D. The low output of the flip-flop also disables NAND gate U2918B, preventing the LOAD flip-flop from being set. Pin 6 of U2919B (part of the READ flip-flop) goes high when $\overline{\text{READ START}}$ occurs. The high enables U2926C. We'll get back to this gate later.

The stored waveform data must be clocked out of the memory by an externally supplied $\overline{\text{READ CLOCK}}$ signal. The clock signal must be low-going with a period greater than 1.6 microseconds. It enters Schematic 13 at the left edge, firing one-shot U2939 through U2933D. The rising edge of the pin 6 output of U2939 increments the memory address counters (to a 1 count in this case), and the period of the one-shot assures stable address levels for the memory.

When U2939 times out, the falling edge fires one-shot U2942. Pin 6 goes high, placing high levels at the inputs of U2937D and U2933C. The lower gate (U2933C) is disabled

during READ mode and its output remains high, which causes the memory array to assume READ mode also.

The upper gate, U2937D, functions as a horizontal detector. Whenever a horizontal address is read from memory, the DATA OUT line (shown just beneath one-shot U2942) goes high. Refer to the bottom edge of the Memory Array schematic (diagram 14) and you will find the source of DATA OUT. Recall that bit 9 of a horizontal data word is automatically set before storage, allowing it to be distinguished from the vertical data words stored. The occurrence of DATA OUT allows U2937D to increment horizontal counter U2945. Reading a vertical data word does not produce DATA OUT, so the horizontal counter does not increment.

When the horizontal count reaches 512, an end-of-frame signal from pin 9 of counter U2949 resets the READ flip-flop and terminates the read cycle. The idle state that results sets both inputs to U2933B high, and its pin 6 output resets the horizontal counters through inverter U2906A. The Read process is non-destructive, and another read cycle can be initiated immediately.

CONVERTER/RECTIFIERS

Block Diagram

The Converter/Rectifiers circuit provides the operating power for the R7912 from an AC line-voltage source. The circuit includes a Line Selector assembly to permit selection of the nominal operating voltage for the instrument. Figure 3-21 shows a detailed block diagram of the Converter/Rectifiers circuit. A complete schematic is given on Diagram 16.

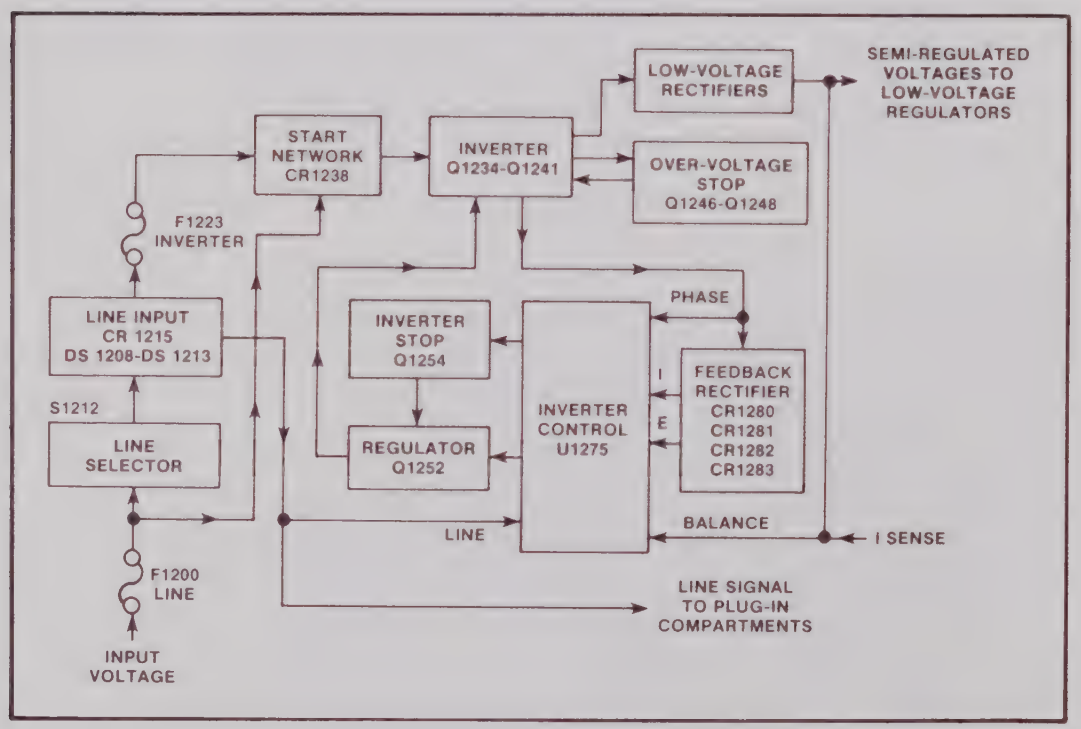


Fig. 3-21. Converter-Rectifiers block diagram.

Line Input

Power is applied through the Line Filter, line fuse F1200, POWER switch S1200, and Line Selector switch S1212. The Line Filter is designed to keep power-line interference from entering the instrument and to keep the 25-kilohertz Inverter signal from entering the power line. L1201-L1203, with C1201-C1203, provide EMI (electromagnetic interference) filtering. R1201 and R1203 provide common-mode resonance damping. R1205, C1205, and C1206 suppress reverse-recovery transients of CR1215.

Line Selector switch S1212 allows the R7912 to operate from either a 115-volt nominal or a 230-volt nominal line-voltage source. In the 115-volt position, rectifier CR1215 operates as a full-wave doubler with energy-storage capacitors C1216 and C1217, so the voltage across the two capacitors in series will be the peak-to-peak value of the line voltage. For 230-volt operation, CR1215 is connected as a bridge rectifier and the voltage across C1216-C1217 is the peak value of the line voltage. As a result, the output voltage applied to the Inverter stage is about the same for either 115-volt or 230-volt operation.

Thermistor R1209 limits the surge current demanded by the power supply when it is first turned on. After the instrument is in operation, the resistance of the thermistor drops so it has little effect on the operation.

When the R7912 is turned off, the Inverter is turned off by the Inverter Control Line Stop stage to prevent the sudden discharge of C1216 and C1217; C1216 and C1217 discharge slowly through R1221. The discharage time-constant of C1216-C1217-R1221 is about equal to the thermistor thermal-recovery time. This ensures sufficient thermistor resistance to limit the turn-on surge current to a safe level.

WARNING

Since C1216 and C1217 discharge slowly, dangerous potentials exist within the power supply for several minutes after the POWER switch is turned off. The presence of voltage in the circuit is indicated by the relaxation oscillator formed by R1219, C1219, and DS1219. Neon bulb DS1219 will blink until the potential across C1216-C1217 drops to about 80 volts.

DS1208-DS1213 are surge-voltage protectors. When the Line Selector switch is in the 115-volt position, only DS1208 is connected across the line input. If a peak voltage greater than 230 volts is present on the line, DS1208 will break down and demand high current. This excess current will quickly open line fuse F1200 to interrupt the input power before the instrument can be damaged. In the 230-volt position, DS1208 and DS1213 are connected in series across the line input to provide protection for peak voltages greater than 460 volts.

Transformer T1208 provides a sample of the line voltage to the plug-in connectors in the Main Interface circuit for internal triggering at line frequencies. This line-frequency signal is also connected to the Inverter Control Line Stop stage to indicate when line voltage is applied and the POWER switch is on. F1223 protects the Inverter stage if excessive current is demanded due to a malfunction.

Start Network

Voltage divider R1210-R1242 is connected between the input line (AC) and the negative side of C1217 (through T1225). The voltage across R1242 charges C1242 on each half cycle of the input line voltage. When the charge on C1242 reaches about 32 volts, trigger diode CR1238 conducts and C1242 is discharged through CR1238, providing base drive for Q1241 through C1239.

When Q1241 is turned on, it shock-excites series-resonant network L1237-C1237 to generate a damped oscillation. This damped oscillation provides the drive necessary to start the Inverter switching action. After the Inverter is operating, the recurrent waveform at the collector of Q1241 keeps C1242 discharged through CR1242. This disables the Start Network while the instrument is on.

Inverter

The Inverter stage converts the DC output of the Line Input stage to a sine-wave current to drive Power Transformer T1310. Once the Inverter has been started by the Start Network, transformer T1230 provides feedback to the bases of Q1234 and Q1241 to sustain oscillation. The polarity of the windings causes Q1234 and Q1241 to switch alternately. These transistors operate at a forced beta of four due to the turns ratio of T1230. Also, T1230 provides an input from the Inverter Control and Regulator stages for pre-regulation and fault protection. This is accomplished by effectively short-circuiting one-half of the 60-turn, center-tapped winding to either delay the turn-on of Q1234-Q1241 or to completely stop their switching action.

The switching action of Q1234-Q1241 generates a square-wave voltage at the emitter of Q1234 with an amplitude approximately equal to the DC voltage at the input of this stage. The square-wave voltage at the emitter of Q1234 supplies the drive necessary to maintain a sine-wave current in the series-resonant network of L1237-C1237. Diodes CR1234 and CR1241 provide reverse-conduction paths across Q1234 and Q1241 respectively when these transistors are held off for pre-regulation.

As an aid in understanding circuit operation, Fig. 3-22a shows a representation of the Inverter stage with a DC input voltage equal to E. The three possible states of the Inverter are depicted by the three possible positions of switch S1: Q1234 is on in position (a); Q1241 is on in position (c); or, both transistors are held off for pre-regulation in position (b).

In the composite current waveform of Fig. 3-22b, the relative phase and amplitude of each component of I_t is shown for periods T_a, T_b, and T_c, corresponding to the three positions of S1 or the three states of the Inverter. The idealized voltage waveforms in Fig. 3-22(c) and Fig. 3-22(d) show the relationship of their amplitude to the DC input voltage and their phase with respect to the current waveforms of Fig. 3-22b.

The normal sequence of events is as follows: Assume that the current in the series-resonant circuit I_t is passing through zero and is increasing in the direction causing CR1234 to conduct. At zero crossing, the Regulator stage (Q1252) is turned on, holding Q1234 off and Q1241; CR1234 is forward biased to conduct I_1. After zero crossing, at a time determined by the Inverter Control stage, the Regulator allows Q1241 to conduct and reverse bias CR1234. Q1241 conducts as I_2 goes through its peak and back to zero. At zero crossing, with current increasing in the

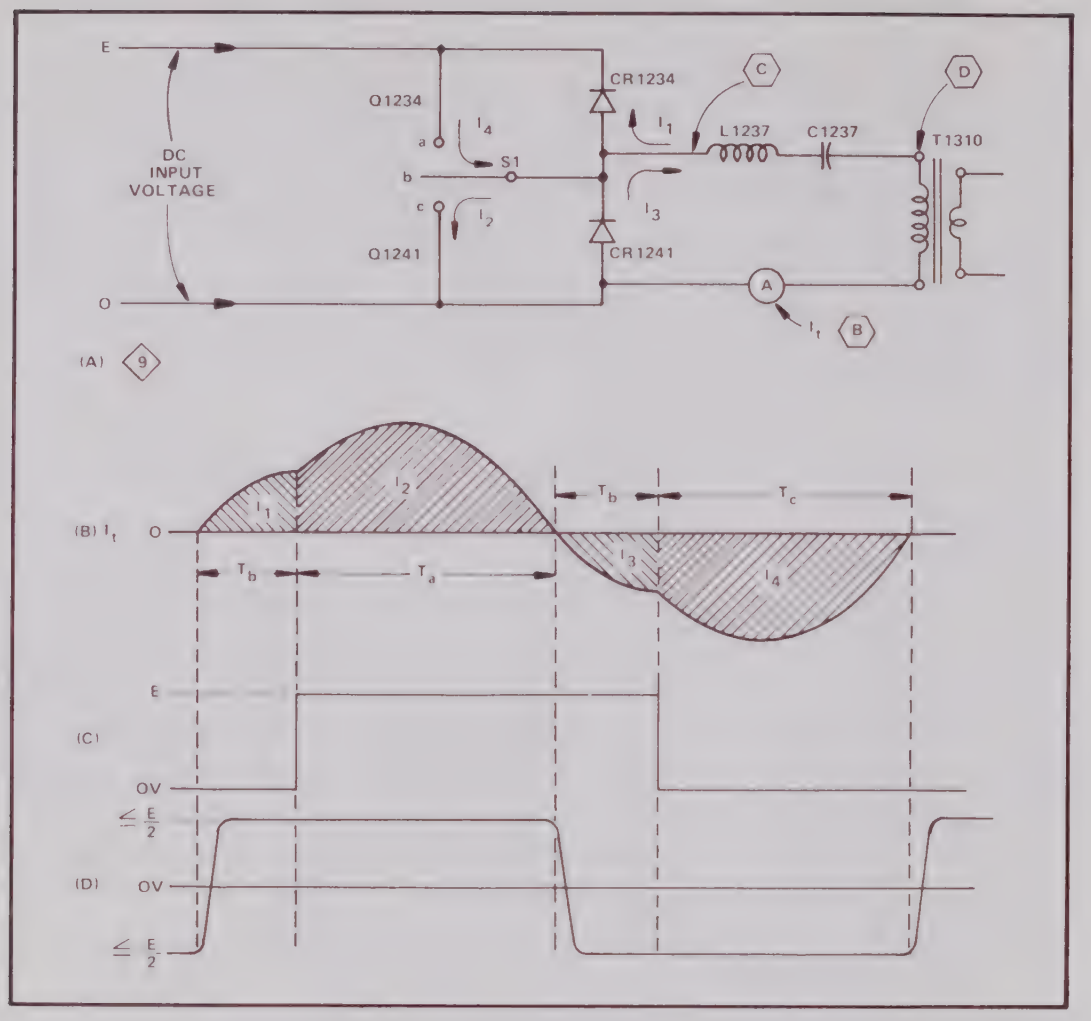


Fig. 3-22. Simplified portion of Converter-Rectifiers circuit.

opposite direction, the Regulator is turned on, holding Q1234 and Q1241 off. During this pre-regulation hold-off time, CR1241 conducts I_3. When the Regulator is turned off, Q1234 is turned on to conduct I_4 and reverse bias CR1241. Q1234 conducts as I_4 goes through its peak and back to zero. The cycle then repeats itself.

The Inverter operates on the low side of the resonant frequency of L1237-C1237, which is about 29 kilohertz. Pre-regulation is achieved by varying the hold-off time of the Inverter transistors, (T_b in Fig. 3-22b) thereby varying the Inverter frequency. The power delivered to T1310 varies with the Inverter frequency because the impedance of the series-resonant network varies with frequency. If either the line voltage is increased or the load is reduced, the Inverter frequency will decrease.

Over-Voltage Stop

The Over-Voltage Stop stage stops the Inverter whenever the voltage across the primary of T1310 exceeds a safe level. C1243 is charged through CR1244 to the peak of the voltage across the primary of T1310. If this voltage exceeds a safe level, VR1246 conducts to trigger Q1248 into its forward-conduction state. C1243 then discharges through R1248, Q1248, and the base-emitter junction of Q1246. This discharge current turns on Q1246 to effectively short-circuit the base-drive winding of T1230 and stop the Inverter switching action.

Since CR1249 becomes forward biased when Q1248 is turned on, R1245-C1243 is effectively paralleled with C1242 in the Start Network. The relatively large capacitance of C1243 prevents C1242 from charging to the breakdown voltage of CR1238, thus preventing the Start Network from turning the Inverter on. Q1248 and Q1246 continue to conduct until

the discharge current of C1243 drops below the holding current of Q1248. After Q1248 returns to its forward-blocking state, CR1249 remains forward biased to inhibit the Inverter Start Network. C1243 begins charging through R1247. When the charge on C1243 is sufficient to reverse bias CR1249, the Start Network is enabled.

Inverter Control

The Inverter Control stage, made up primarily of U1275, provides pre-regulation and fault protection for the low and high-voltage power supplies. For pre-regulation purposes, U1275 provides base drive to the Regulator stage (Q1252), which controls energy delivered by the Inverter by varying the operating frequency. Fault protection is achieved through the Regulator output (as for pre-regulation) or by providing a Stop Trigger output to the Inverter Stop stage to turn the Inverter off.

U1275 includes a variable pulse-width monostable multivibrator which is triggered by current and phase information fed back from the Inverter. The charge ramp for the multivibrator is available at pin 12 of U1275. R1300 and C1300 determine the rate-of-rise of the charge ramp. The sensing inputs to U1275 determine the pulse width of the charge ramp. The pulse width of the charge ramp corresponds to the Inverter hold-off time (T_b, in Fig. 3-22b). The multivibrator Regulator output drives the Regulator stage through pin 9 of U1275.

Under normal operating conditions, only the E Sense input at pin 15 has control over the output pulse width. However, an error detected by any of the sensing inputs will affect the output pulse width and will also produce a Stop Trigger signal for the Inverter Stop stage. The operation of each function of the Inverter Control stage is described in the following discussion.

Pre-Regulator. The Pre-Regulator portion of U1275, in conjunction with the Regulator stage, maintains constant voltages at the outputs of the Low- and High-Voltage Rectifiers.

Transformer T1235 provides Inverter power and phase information to U1275. The phase information is connected to the trigger input of the Inverter Control Multivibrator via pins 10 and 11 through C1275 and C1276. Bridge rectifier CR1280-CR1281-CR1282-CR1283 provides positive and negative operating voltages to U1275. A shunt regulator in U1275 regulates the +7.5-volt output of the bridge rectifier connected to pin 6. The -2-volt (nominal) output connected to pin 7 is unregulated. VR1297 provides a stable reference voltage for the sensing-divider resistors R1292-R1293-R1294-R1296-R1297. R1293 adjusts the voltage level at the E Sense input to the Pre-Regulator (pin 15 of U1275). This level sets the output voltage of the rectifiers by controlling the +130-Volt Supply. The output of the other supplies is set by the turns ratio of T1310.

In the stable state of the Inverter Control multivibrator, the Regulator ouput at pin 9 is near ground, turning off the Regulator stage. After the Inverter current passes through zero, either pin 10 or pin 11 goes positive to turn on the Inverter Control multivibrator. While the multivibrator is on, the Regulator output voltage level is positive, turning on the Regulator stage. The duration of the on state is determined by the voltage level at the E Sense input at pin 15. If this voltage level is low, the duration is short. As this voltage level increases, the duration increases.

Fault Protection. The fault-protection portions of U1275 provide protection for the power-supply components from damage due to short circuits, turn-on surge currents, and other malfunctions. When a fault is detected at the Balance or I Sense inputs (pins 2 and 13 respectively), current from the Fault Holdoff Time output (pin 1) charges C1264. If the detected fault lasts longer than about 15 milliseconds, C1264 will charge positive enough to produce a positive Stop Trigger output at pin 8 to turn the Inverter off.

When the Inverter is shut off, the current charging C1264 is interrupted and C1264 discharges. Once pin 8 goes positive, C1259 discharges through R1261 and the base-emitter junctions of Q1254 and Q1252. The discharge of C1259 keeps Q1254 and Q1252 turned on, and the Inverter

turned off, for about 250 milliseconds. After this period, pin 8 returns to a near zero-volt level, turning off Q1254 and Q1252 to allow the Inverter to run. This cycle repeats until the fault is corrected, with the Inverter on for about 15 milliseconds then off for about 250 milliseconds.

Inverter Current Limiter. The Inverter Current Limiter provides protection for the Inverter components from damage due to excessive current. Operation of this stage is similar to the Pre-Regulator stage. The Inverter Current Limiter controls the Inverter Control Regulator output pulse-width during turn-on or whenever an overload causes the Inverter to reach the limit value.

R1287 is the current-sensing resistor. The voltage at the junction of R1287-R1286-CR1288 results from the negative rectified Inverter current. The I Sense input at pin 13 is normally held positive through R1285. If the Inverter current increases, the voltage at the I Sense input becomes more negative. The Inverter Control Regulator output pulse width (the Inverter hold-off time) increases until the Inverter current reaches a level that will hold pin 13 near the zero-volt level. If the voltage at pin 13 remains near zero for more than approximately 15 milliseconds, the Stop Trigger output at pin 8 goes positive, triggering the Inverter Stop stage. The Inverter Current Limiter limits the peak Inverter current to about five amperes under fault con-

ditions.

Balance. The Balance portion of U1275 provides overload protection for the Low-Voltage Rectifiers by sensing a malfunction in these circuits. Sense inputs from the Low-Voltage Rectifiers are applied to the Balance Sense input at pin 2 of U1275 through divider R1302-R1304-R1305. During normal operation, this divider biases the Balance Sense input to near a zero-volt level. If one of the inputs changes enough to cause the voltage level at pin 2 to vary over about 200 millivolts (positive or negative) for more than 15 milliseconds, a positive Stop Trigger output is produced at pin 8 of U1275.

Line Stop. The Line Stop portion of U1275 protects the Line-input components from damage due to turn-on surge current. This is achieved by triggering the Inverter Stop stage to stop the Inverter when the POWER switch is turned off. The Line Stop stage will also stop the Inverter if the AC line voltage falls below a minimum value.

The line-frequency signal from transformer T1208 is connected to the Line Stop Sense input of U1275 at pin 4. During normal operation, the line-frequency signal causes the Line Stop Timer terminal (pin 3) to be near a zero-volt level (ground). This zero-volt level keeps C1267 from being charged toward +7.5 volts through R1267. When the line-frequency signal is interrupted or falls below a minimum value, C1267 will begin to charge to +7.5 volts. When the

voltage at pin 3 reaches approximately +0.7 volt, the Line Stop stage produces a positive Stop Trigger output at pin 8 of U1275 to stop the Inverter.

Regulator

The Regulator stage operates in conjunction with the Inverter Control and Inverter Stop stages to regulate Inverter switching. Q1252 acts as a switch controlled by the Regulator output of U1275 (pin 9) or by the Inverter Stop stage.

When Q1252 is turned on, either CR1251 or CR1252 is forward biased. This effectively short circuits one-half of the 60-turn, center-tapped winding of T1230 to shut off the Inverter. For further information, see the discussion of the Inverter stage.

Inverter Stop

The Inverter Stop stage, Q1254, is controlled by the Stop Trigger output of U1275 (pin 8) to shut off the Inverter through the Regulator stage (Q1252). During the start period, T1230 supplies current to charge C1256 and C1259 through CR1256 and CR1259. During this time, Q1254 is reverse biased by U1275. Once turned on by a positive Stop Trigger, Q1254 will stay on while C1256-C1259 discharge through its base-emitter junction. If U1275 is removed from its socket or is otherwise non-functional, the Inverter Stop stage stops the Inverter after about two or three

cycles.

Low-Voltage Rectifiers

The rectifiers and filter components in the secondaries of T1310 provide rectified, pre-regulated voltages for re-regulation by the Low-Voltage Regulators circuit.

LOW-VOLTAGE REGULATORS

General

The Low-Voltage Regulators convert semi-regulated voltages from the Converter/Rectifiers circuit to stabilized, low-ripple output voltages. The regulators are series type, using the -50 Volt Supply as a reference for the remaining voltage supplies. Figure 3-23 shows a detailed block diagram of the Low-Voltage Regulator circuits. A schematic is given on Diagram 17.

-50 Volt Supply

Semi-regulated -54 volts from the Converter/Rectifiers circuit provides the unregulated voltage source for this supply. Transistors Q1508-Q1522-Q1534 operate as a feedback-stabilized amplifier to maintain a constant -50 volt output level. Q1508 is comparator-connected to compare the feedback voltage at the base of Q1508B against the reference voltage at the base of Q1508A. The error output at the collector of Q1508B reflects the difference, if any,

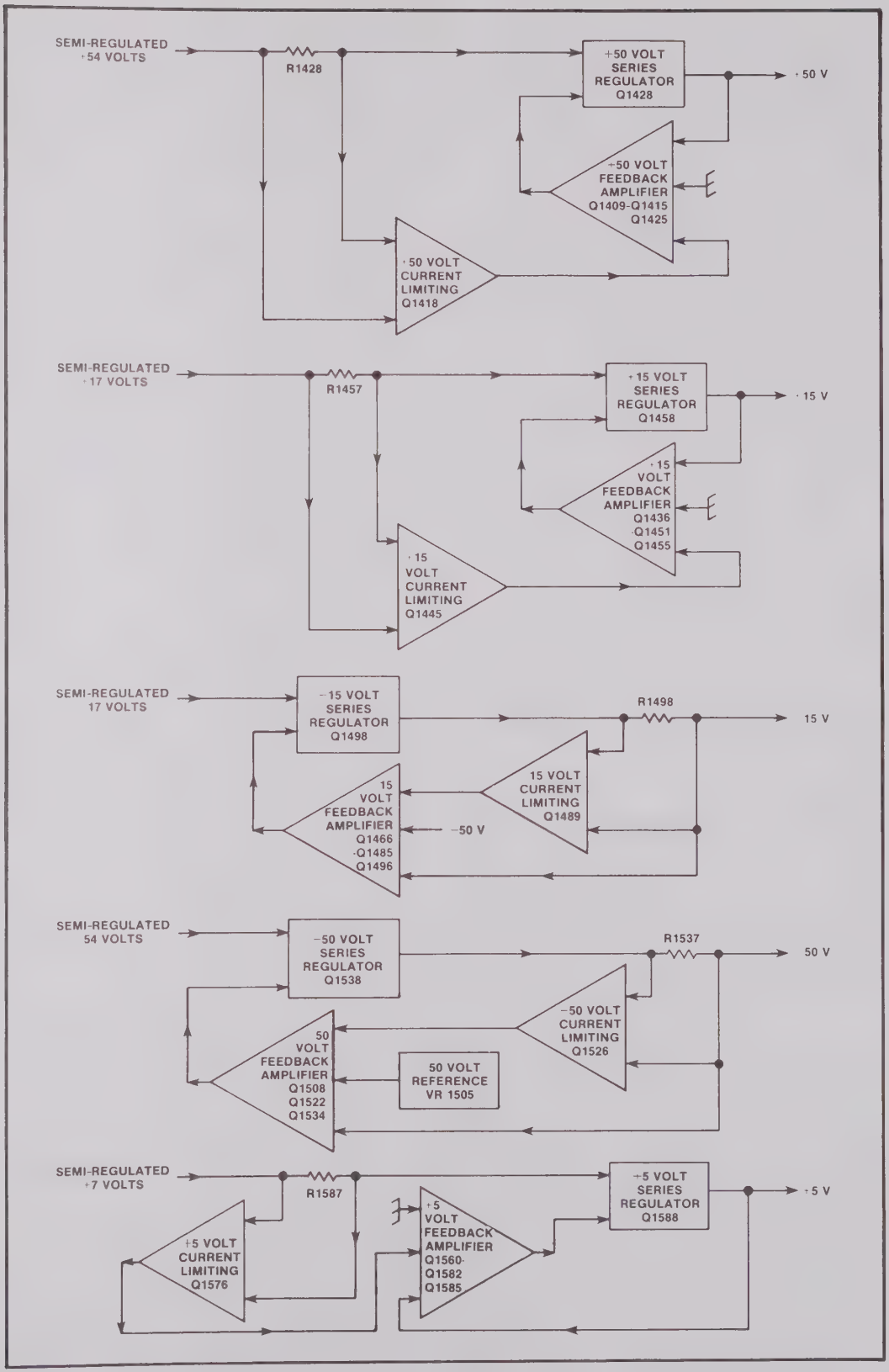


Fig. 3-23. Low-voltage Regulator block diagram.

between these two inputs. The change in error output level at the collector of Q1508B is always in the opposite direction to the change in the feedback input at the base of Q1508B.

Zener diode VR1505 sets a reference level of about -9 volts at the base of Q1508A. A sample of the output voltage from the -50 Volt Supply is connected to the base of Q1508B through divider network R1512-R1513-R1514. R1513 in this divider adjusts the output voltage level of the supply. Notice that the feedback voltage to the divider is obtained from a line labeled -50 V Sense. If the feedback voltage were obtained at the supply, the voltage at the load would not stay constant due to the inherent resistance of the interconnecting cable between the supply and its load (as the load current varies, the voltage drop along the cable also varies). The Sense configuration overcomes this problem by sensing the voltage at the load. Since the current in the Sense line is small and constant, the load voltage is held constant regardless of the load current.

Regulation of the supply occurs as follows: If the output level decreases (becomes less negative) due to an increase in load or a decrease in input voltage (as a result of line-voltage changes or ripple), the voltage across divider R1512-R1513-R1514 decreases also. This results in a more positive level at the base of Q1508B than that established by the -50 Volt Reference stage at the base of

Q1508A. Since the transistor with the more positive base controls the conduction pair, the output current at the collector of Q1508B increases. This increase in output from Q1508B causes an increase in current through Q1522. More current flows through Q1534, resulting in increased conduction of Q1538, the -50 V Series Regulator. The load current increases and the output voltage of the supply also increases (becomes more negative). As a result, the feedback voltage from the -50 V Sense line increases and the base of Q1508B returns to the same level as the base of Q1508A. Similarly, if the output level of this supply increases (becomes more negative), the output current of Q1508B decreases. The feedback through Q1522 and Q1534 reduces the conduction of the -50 V Series Regulator to decrease the output voltage of the supply.

The -50 V Current Limiting stage (Q1526) protects the -50 Volt Supply if excess current is demanded. Since the load is connected through R1537, all current drawn from the supply flows through this resistor. Transistor Q1526 senses the voltage drop across R1537.

During normal operation there is insufficient voltage drop across R1537 to forward bias Q1526. However, when excess current is demanded from the -50 V Series Regulator due to a short circuit or similar malfunction, the voltage drop across R1537 increases until it is sufficient to forward bias Q1526. The collector current of Q1526 results

in a reduction of current through Q1522 and Q1534 to limit the conduction of Q1538. This current limiting protects Q1538 from damage due to excess power dissipation.

Several protection diodes are also included in the circuit. CR1539 prevents the output voltage from going more positive than about +0.6 volt if it is shorted to a positive supply. VR1501 and CR1502 provide a turn-on voltage for Q1508 to start the -50 Volt Supply when the instrument is first turned on. As soon as the -50 Volt Supply turns on, VR1501 and CR1502 turn off, removing the turn-on voltage from Q1508.

-15 Volt Supply

Basic operation of all stages in the -15 Volt Supply is the same as for the -50 Volt Supply. Reference level for this supply is established by divider R1463-R1464 between ground and the -50 V Sense voltage. The divider ratio of R1463-R1464 sets a level of -15 volts at the base of Q1466A. The level on the -50 V Sense line is held stable by the -50 Volt Supply. Any change at the output of the -15 Volt Supply appears at the base of Q1466B as an error signal. The output voltage is regulated in the same manner as described for the -50 Volt Supply. CR1499 clamps the output at +0.6 volt if it is shorted to one of the positive supplies. Diodes CR1468 and CR1469 provide reverse voltage protection for transistors Q1466B and Q1466A, respectively.

+5 Volt Supply

The operation of the +5 Volt Supply is basically the same as described for previous supplies. The reference level for this supply is established by the ground connection at the base of Q1560A. Feedback voltage to the base of Q1560B is provided by divider R1564-R1589 between the -50 V Sense line and the +5 V Sense line. The divider ratio of R1564-R1589 is 10:1, so the base of Q1560B is at zero volts when the supply is operating normally. The level on the -50 V Sense line is held stable by the -50 Volt Supply. Any change at the output of the +5 Volt Supply appears at the base of Q1560B as an error signal. The output voltage is regulated in the same way as described for the -50 Volt Supply. Diode CR1589 clamps the output to about -0.6 volt if it is shorted to one of the negative supplies.

The +5 Volt Current Limiting stage (Q1576A and B) protects the supply from damage due to a demand for excessive output current. Q1576A and Q1576B are connected as a comparator to detect excessive current through R1587. With normal supply current through R1587, the voltage drop across R1587 is such that the base of Q1576B is more positive than the base of Q1576A. Therefore, Q1576A is cut off and CR1576 is reverse biased. If the current through R1587 increases above a safe level, the base of Q1576B becomes more negative than the base of Q1576A. Then Q1576B is cut off and Q1576A conducts. The collector current of Q1576A forward

biases CR1576 and decreases the voltage on the base of Q1582. This limits the conduction of Q1588 to a safe current level.

+15 Volt Supply

The +15 Volt Supply regulates in the same manner as the -50 Volt Supply; current limiting operates in the manner described for the +5 Volt Supply. The ground connection at the base of Q1436A provides the reference voltage. Feedback voltage to the base of Q1436B is provided through divider R1440-R1459 between the -50 V Sense line and the +15 V Sense line. The divider ratio of R1440-R1459 sets the base of Q1436B at zero volts. Any change in the output level of the +15 Volt Supply appears at the base of Q1436B as an error signal. This results in an opposite change at the collector of Q1436B and at the base of Q1451. This change is connected to the +15 V Series Regulator stage through Q1455 to correct the error in the output voltage.

Diode CR1439 protects Q1436B against negative voltages if the +15 Volt Supply is shorted to ground. Diode CR1459 clamps the output to about -0.6 volt if it is shorted to one of the negative supplies.

+50 Volt Supply

Operation of the +50 Volt Supply is basically the same as described for the -50 Volt Supply; current limiting operates in a similar manner as described for the +5 Volt Supply. Reference voltage is established by the ground connection through R1406 at the base of Q1409A. Feedback voltage to the base of Q1409B is provided by divider R1412-R1429 between the -50 V Sense line and -15 V Sense line. The divider ratio of R1412-R1429 sets the base level of Q1409B at zero volts during normal operation.

Z-Axis and High Voltage

The Z-Axis and High Voltage circuits generate the signals and voltage levels required by the Write portion of the R7912 Scan Converter tube. A regulated -10-kilovolt cathode supply and a -6-kilovolt focus supply are included, as well as a fast Z-Axis (blanking) amplifier. Protection circuitry for the Scan Converter target providing beam deflection and drive for a blinking front-panel LED warning indicator is also incorporated.

Overview

The Z-Axis and High Voltage schematic is located on diagram 18. Referring to that diagram, note at the top center a representation of the Write portion of the Scan Converter tube. To the right of the tube is the protection circuitry and two astigmatism controls. To the left is the high-voltage supply. At bottom left is the Z-Axis circuit, providing blanking signals to the Scan Converter. Let's start with the high voltage supply.

High Voltage Supply

At the left edge of the schematic are two NPN transistors, Q1634 and Q1636, driving the primary of an inverter transformer, T1633. The transistors receive power from an unregulated $\pm$ 17-volt supply, and the LC filter composed of L1637 and C1637 reduces any ripple that may be present. The inverter oscillates at about 20 kilohertz, using small base windings for feedback to sustain the oscillation.

Two secondary windings are apparent on T1633. The upper winding provides a -6-kilovolt focus voltage, and the lower winding provides -10-kilovolts for the cathode and control grid. We'll discuss the lower -10-kilovolt supply first.

-10 Kilovolt Supply. The 20-kilohertz output of T1633 is applied to a full-wave rectifier/voltage-doubler composed of CR1640, CR1642, CR1643, CR1644, C1643, C1644, CR1646, and CR1647. Output from the doubler is filtered by C1648, then applied to a pi-network filter (near the Scan Converter illustration) composed of C1662, C1665, and C1667. Input resistance is provided by R1647 near the doubler circuit. Down below the three filter capacitors is a darlington transistor (Q1728) connected as a capacitance multiplier. Ripple coupled through C1665 is inverted and amplified by Q1728 and returned through C1667, effectively cancelling the ripple.

The circuit is protected from the damaging effects of an arc-over in the Scan Converter tube by diodes CR1724 and CR1729. Extensive circuit protection against interelectrode arcing is used in all portions of the Z-Axis and High Voltage circuits.

Blanking and D.C. Restoration. The -10-kilovolt supply provides bias for the Scan Converter control grid through the circuitry shown at the right of the voltage doubler. The top secondary winding of T1633 provides a high amplitude sine wave through R1629 to the D.C. restorer circuit. Diode CR1652 clamps the positive excursion of the sine wave at the CRT Grid Bias setting, which ranges from +50 to +130 volts. A typical setting results in a +90-volt clamp level.

The negative excursion is clamped at the current Z-Axis blanking level by CR1656. The Z-Axis signal enters at the lower right of the restorer circuit through R1664, and for purposes of example, ranges from about +10 volts (blanked) to +45 volts (unblanked). The actual level is determined by the intensity control and by the Scan Converter characteristics. The clipped sine wave results in a square wave similar to that shown in Fig. 3-24a. The upper level is established by the CRT Grid Bias control, and the lower level by the Z-Axis signal.

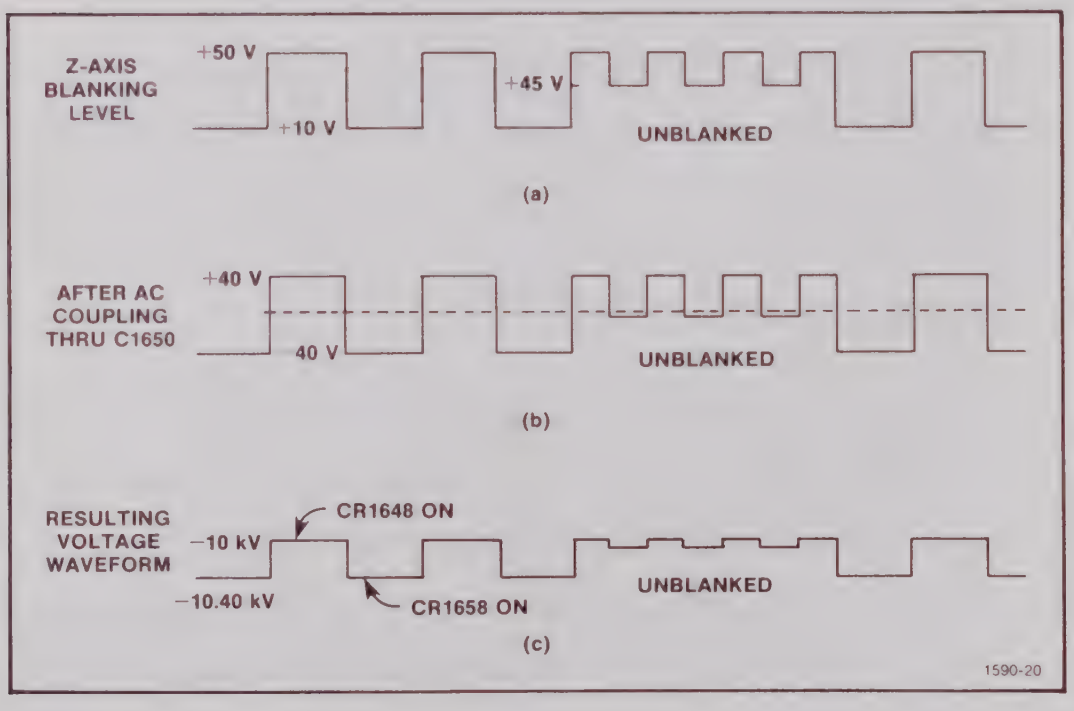


Fig. 3-24. Z-Axis blanking and DC restoration.

The square wave is AC coupled to the -10-kilovolt grid bias supply through C1650. Positive excursions are clipped at the -10-kilovolt supply level by CR1648. Negative excursions reverse-bias that diode and turn CR1658 on. C1657 (to the right of the diode) is quiescently charged to the -10 kilovolt supply level. Current through CR1658 pulls the voltage on C1657 below -10 kilovolts by the amount of blanking signal applied. Figures 3-24b and c describe the process.

The potential on C1657 is applied to the control grid through R1661. When unblanking occurs, the square wave amplitude is reduced and the voltage on C1657 returns to near -10 kilovolts. This unblanks the writing beam.

Protecting the Circuit. Neon spark gaps protect several sensitive components in the DC restoration circuit from the damaging effects of interelectrode arcing in the Scan Converter tube. These devices conduct if their terminal voltage difference exceeds about 145 volts, protecting the diodes in the circuit from excessive voltage and current levels. When a surge protector fires, its terminal voltage drops to about 90 volts. The voltage holds there until the current passed exceeds about 1 ampere. At that point, the protector arcs over and its terminal voltage drops to about 15 volts. Considerable currents must be passed by these devices to charge or ischarge circuit capacitances during arc-over conditions.

Focus Supply. The -6-kilovolt focus voltage is developed with a DC restorer circuit much like that used for the Z-Axis signal. The same sine wave from the top secondary of T1633 is used. The sine wave is passed through R1628 to CR1622, where the negative excursions are clamped near ground potential. Positive excursions are clamped by CR1621 at the level set by the front-panel FOCUS control.

The clipped sine wave is AC coupled through C1621 to the focus D.C. restorer. Focus voltage is obtained from the -10 kilovolt supply through a voltage divider consisting of R1623, R1622, and R1621. R1622 is a preset adjustment for the focus voltage. Positive excursions of the clipped sine wave are clipped at the focus supply voltage by CR1624, and negative excursions pull the voltage on C1626 down. The focus grid swings more negative as the charge on C1626 increases.

Regulation. The -10-kilovolt supply voltage is divided across R1616, R1615, R1614, and R1613. The resulting voltage is applied to operational amplifier U1605 (upper left corner of the schematic). The output of U1605 drives Q1602, thereby controlling the base current to oscillator transistors Q1634 and Q1636. A decrease in output voltage causes U1605 to increase base current to Q1602, increasing drive to the oscillator. The increased drive causes the oscillator pulse width to increase, raising the output voltage to the proper level. Note that the High Voltage ad-

justment also affects the input voltage to U1605, allowing control of the cathode supply.

Z-Axis Amplifier

The Z-Axis amplifier is located in the bottom left corner of your schematic. It accepts signals from either the Z-Axis Logic or the Readout/Graticule circuits and amplifies them to the levels required by the Scan Converter. Special care is taken in the amplifier to insure adequate rise and fall times for the 500 picosecond/division sweep rates possible in the R7912.

Input Circuits. The current drive signals from Z-Axis Logic and the Readout/Graticule circuits are summed at the base of Q1678. This is the null point for the operational amplifier-connected Z-Axis amplifier. The feedback network can be found at the top of the circuit in R1703, R1707, R1705 and the associated capacitors. The Readout/Graticule signal is level-shifted by Q1672 to be compatible with the Z-Axis logic signal level. Q1676 temperature-compensates input transistor Q1678. Q1678 (at the bottom) provides a reduced supply voltage for the amplifier circuits.

Positive Excursions. Positive-going drive signals reduce the current through Q1678, forward-biasing Q1689. Zener diode VR1680 maintains D.C. compatibility between the stages. As Q1689 turns on, its emitter goes more negative, forward biasing common-base amplifier Q1694. Current from C1688 (at the bottom right of the circuit) is coupled through the two

transistors to charge the control grid capacitance at the output of the Z-Axis amplifier. This current path allows the unblanking signal to switch very fast despite the characteristic capacitance of the grid structure and associated wiring.

Negative Excursions. Negative-going drive signals increase the current through input transistor Q1678 and its collector voltage rises. Emitter follower Q1682 tracks the rising voltage, and the positive step is coupled from C1682 through Q1682, C1683, R1690, and C1695 to the emitter of Q1698. The pulse turns Q1698 on, quickly discharging the grid capacitance.

Current Source. Q1711 functions as a current source for the output stage of the amplifier, compensating for differing sweep speeds and intensity levels. A sample of the Z-Axis output signal is coupled through R1721 and C1721 to drive the base of Q1711. Positive excursions are passed by CR1718 to the base, while negative excursions are passed by CR1717 and C1714. The R-C network consisting of R1720 and C1720 compensates for a similar network in the grid bias supply -- R1663 and C1656. CR1716 temperature-compensates Q1711, while R1715 provides base current.

Feedback Path. The feedback path for the amplifier consists of R1703, R1705, R1707, C1700, C1705, C1703, and C1707. A High Frequency Peaking adjustment is provided with C1703, and Z-Axis Compensation by R1701. CR1709 acts as a

voltage-variable capacitor, compensating for transient-response variations that accompany sweep-speed and intensity changes.

Target Protection Circuit

The diode target in the Scan Converter tube is sensitive to burns caused by excessive writing beam current density. Burns can be the result of operating at a low sweep speed with a high intensity setting, or reducing sweep speed without first reducing intensity.

To protect the target from gross misadjustment of the front-panel controls, a protective circuit is included that deflects the writing beam off-target whenever excessive current is detected. A flashing LED indicator on the R7912 front panel warns the operator to reduce beam intensity.

Protection Threshold. The protection circuit is shown just to the right of the Scan Converter tube. Just under transistor Q1742 is a diode, CR1744. The anode of CR1744 connects to the output of the Z-Axis amplifier through R1722. Recall that the Z-Axis output typically ranges from about +10 volts (blanked) to about +45 volts (unblanked).

Capacitor C1744 is charged to about +10 volts by the R1745-R1744 voltage divider. When the Z-Axis signal is blanking the write beam, diode CR1744 is reverse-biased. During unblanking the diode conducts for a short time -- the time depending on the sweep rate. Slow sweep rates

result in more current passing through CR1744, adding charge to C1744. Since the front-panel INTENSITY control affects the amplitude of the unblanking pulse, the charge rate of C1744 depends on a combination of sweep speed and intensity adjustment. If the combination could result in target damage, C1744 charges to the threshold voltage of Schmitt trigger Q1748.

Notice that the actual beam current in the Scan Converter tube is also sensed by the protection circuit. Excessive beam current forward-biases Q1742, immediately charging C1744 to the Schmitt threshold level. The actual threshold level of the Schmitt trigger determines the protect level for the Scan Converter tube. R1752 controls the threshold level by setting the bias point for the right half of Q1748.

Deflecting the Beam. When the Schmitt trigger is tripped, the right transistor cuts off. Q1756 (above) is no longer forward-biased, and it cuts off as well. As its collector drops to ground level, Q1759 is turned on and its collector swings positive. The positive level cuts off darlington transistor Q1763 and its collector goes negative to forward-bias Q1766.

Follow the collector of Q1766 downward to Q1738. That transistor turns on as its base rises, connecting -15 volts to the horizontal amplifier. This voltage level effectively forces the writing beam completely off target.

Disabling BEAMFINDER. Just above Q1738 is the BEAMFINDER circuit. The BEAMFINDER compresses any scan into the displayable target area to aid in setting up the instrument. During target protection, however, it would be undesirable to have the just-deflected writing beam returned to the target by the BEAMFINDER button.

For this reason, the protection circuit disables the BEAMFINDER. The feat is accomplished by turning on Q1767 with Q1766. The collector of Q1767 pulls down the input to NAND gate U1770A, preventing the BEAMFINDER button (down below) from having any effect.

The collector of Q1767 also pulls down the RESET inputs to counter U1768. This counter divides down the vertical pulse train from the Sync Generator circuits to produce a blinking signal for the front-panel warning indicator.

ALPHANUMERIC READOUT SYSTEM

Introduction

The Alphanumeric Readout System provides a video monitor display of information encoded by the plug-in units. This display is presented on the monitor CRT and is written on the Scan Converter target on a time-shared basis with the analog waveform display.

The definitions of several terms follow:

Character - A character is a single number, letter, or symbol displayed on the video monitor CRT, either alone or in combination with other characters.

Word - A word is made up of a related group of characters. In the R7912 Readout System, a word can consist of up to ten characters.

Frame - A frame is a display of all words for a given operating mode and plug-in combination. Up to four words can be displayed in one frame. Figure 3-25 shows the position of each word in a complete frame.

Column - One of the vertical lines in the Character Selection Matrix (see Fig. 3-26). Columns C-0 (column zero) to C-10 (column 10) can be addressed in the R7912 system.

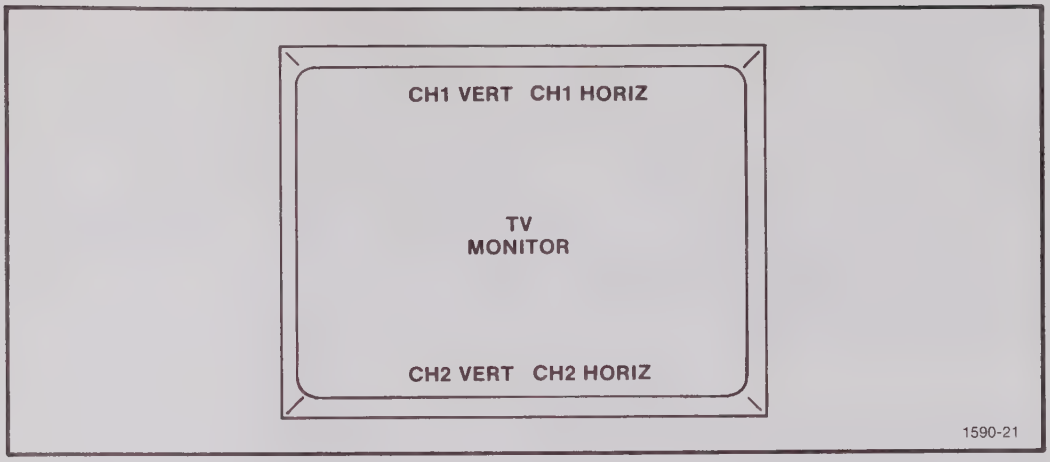


Fig. 3-25. Readout locations.

Row - One of the horizontal lines in the Character Selection matrix. Rows R-1 (row 1) through R-10 (row 10) and R-14 (row 14) can be addressed in the R7912 system.

Time-Slot - A location in a pulse train. In the R7912 Readout System, the pulse train consists of 10 negative-going pulses. Each time-slot pulse is assigned a number between one and ten. For example, the first time-slot is TS-1.

Time-multiplexing - Transmission of data from two or more sources over a common path by using different time intervals for different signals.

Display Format

Up to four words of readout information can be displayed on the monitor CRT. The position of each word is fixed and is directly related to the plug-in unit from which it originated. Figure 3-25 shows the area of the screen where the readout from each plug-in unit is displayed.

Each word in the readout display can contain up to 10 characters, although the typical display will contain between two and seven characters per word. The characters are selected from the Character Selection Matrix shown in Fig. 3-26. In addition, 12 operational addresses are provided for special instructions to the Readout System. The unused locations in the Matrix (shaded area) are available for future expansion of the Readout System. The method of addressing the locations in the Character Selection Matrix is described in the following discussion.

Developing the Display

The following basic description of the Readout System uses the block diagram shown in Fig. 3-27. The description is intended to relate the basic function of each stage to the operation of the overall Readout System. Detailed information on circuit operation is given later.

ROW NUMBER \ COLUMN NUMBER	CURRENT (MILLI-AMPERES)	C-0	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10
		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	≥ 1.0
R-1	0		0	1	2	3	4	5	6	7	8	9
R-2	0.1		∮	<	I	/	+	−	+	C	Δ	>
R-3	0.2		ADD[1] ONE ZERO	ADD[1] TWO ZEROS	SHIFT[1] PREFIX ←	SHIFT[1] PREFIX ← AND ADD ONE ZERO						IDENTIFY[1]
R-4	0.3		m	μ	n	p	X	K	M	G	T	R
R-5	0.4	SKIP[1] ↕	S	V	A	W	H	d	B	c	Ω	E
R-6	0.5		U	N	L	Z	Y	P	F	J	Q	D
R-7	0.6				DECIMAL[1] POINT LOCATION NO. 3	DECIMAL[1] POINT LOCATION NO. 4	DECIMAL[1] POINT LOCATION NO. 5	DECIMAL[1] POINT LOCATION NO. 6	DECIMAL[1] POINT LOCATION NO. 7			
R-8	0.7										DECIMAL[2] POINT	
R-9	0.8											
R-10	0.9	ADD SPACE IN DISPLAY[1]										

1195-25

UNUSED LOCATIONS. AVAILABLE FOR FUTURE EXPANSION OF READOUT SYSTEM

[1] OPERATIONAL ADDRESS.

[2] DECIMAL POINT CHARACTER. SEE DECIMAL POINT CHARACTER DESCRIPTION IN TEXT.

Fig. 3-26. Standard character selection matrix.

Timer. The key block in the Readout System is the Timer stage. This stage produces the basic signals that establish the timing sequences within the Readout System. Period of the timing signal is about 250 microseconds (drops to about 210 microseconds when Display-Skip is received; see detailed description of Timer stage for further information). This stage produces control signals for other stages within the circuit and interrupt signals to the Vertical Amplifier, Horizontal Amplifier, and Logic circuits.

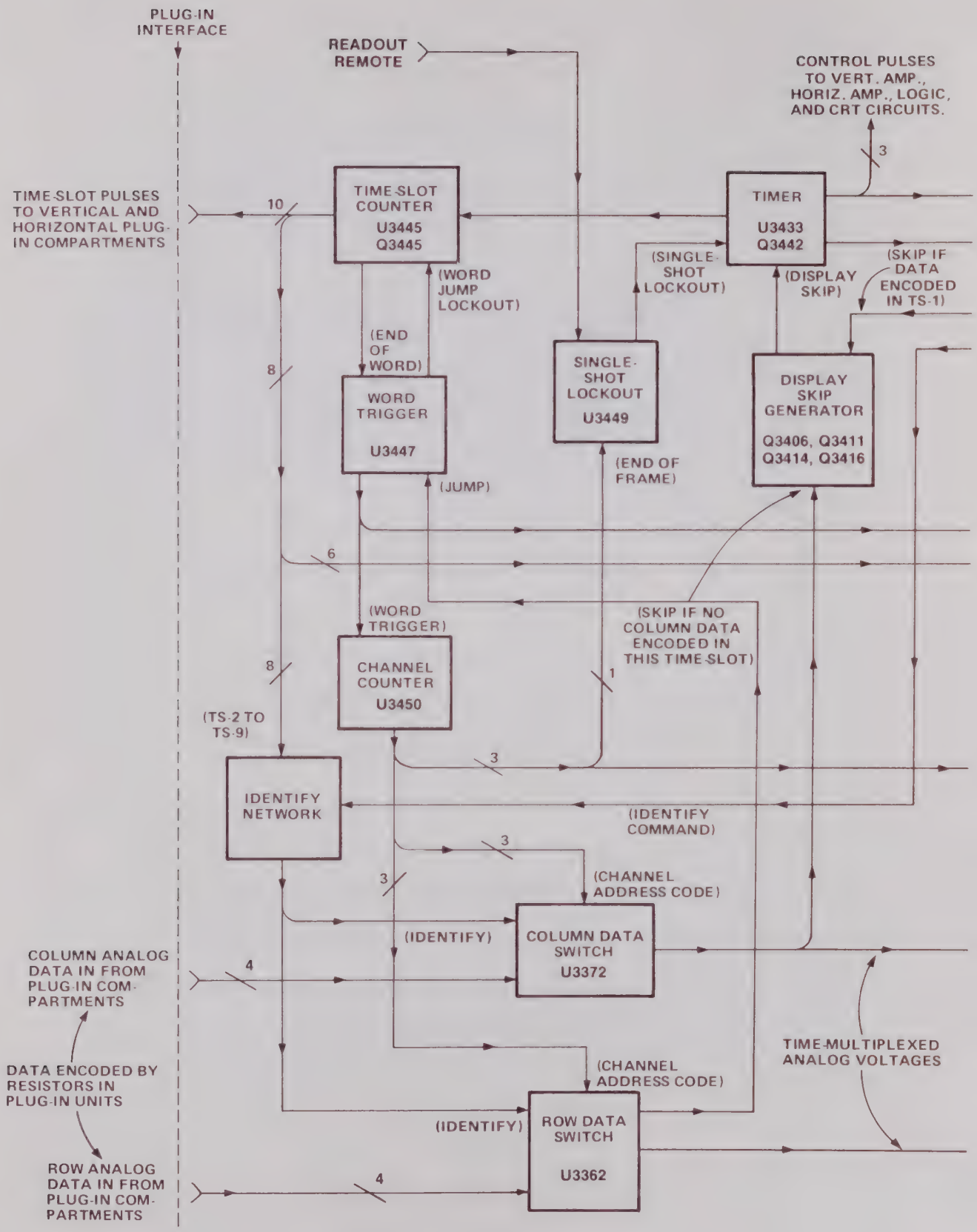


Fig. 3-27. Alphanumeric Readout System block diagram.

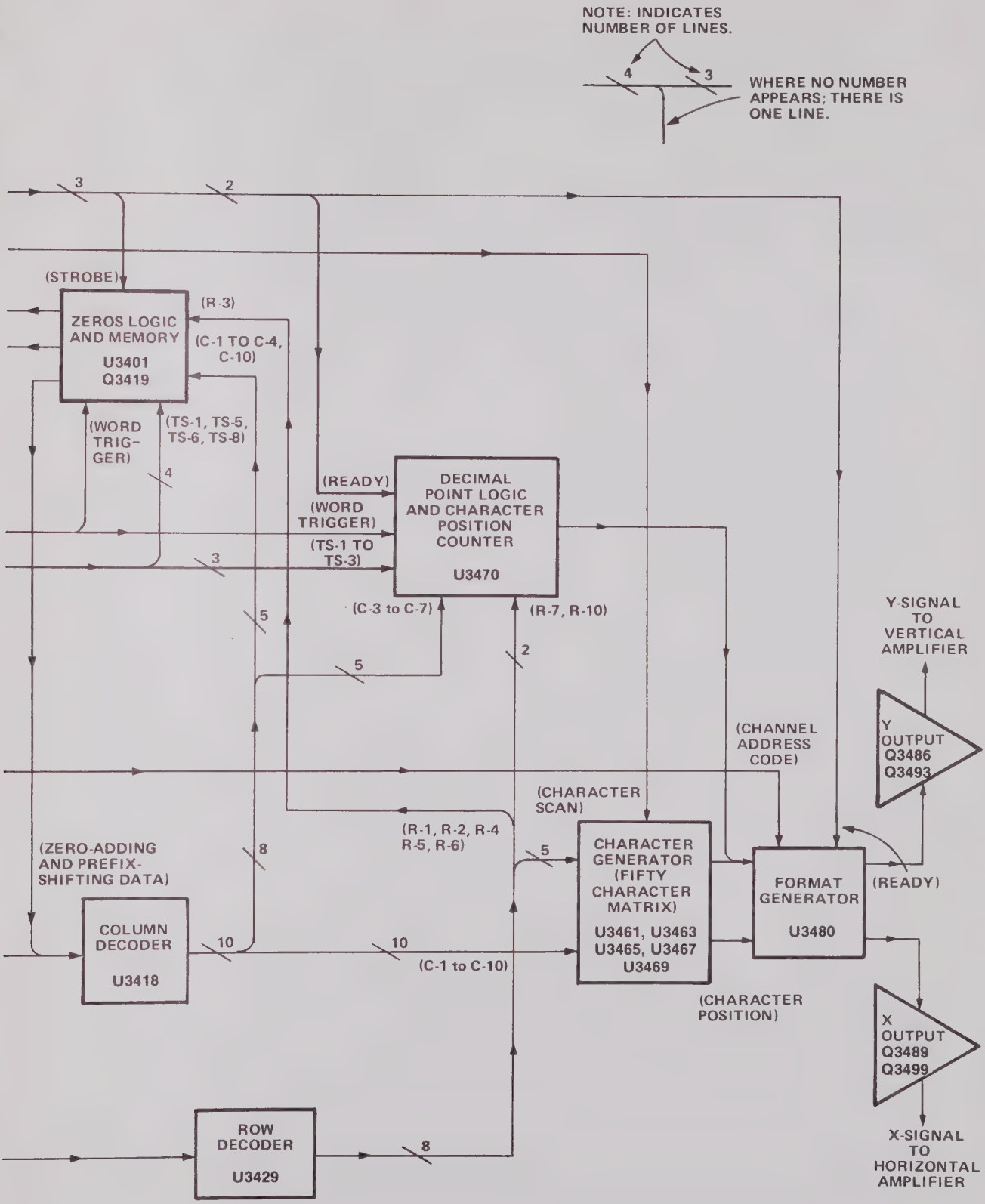

NOTE: INDICATES NUMBER OF LINES.
4
3
WHERE NO NUMBER APPEARS; THERE IS ONE LINE.
3
2
(STROBE)
ZEROS LOGIC AND MEMORY
U3401
Q3419
(R-3)
(C-1 TO C-4, C-10)
(WORD TRIG-GER)
(TS-1, TS-5, TS-6, TS-8)
4
(READY)
(WORD TRIGGER)
(TS-1 TO TS-3)
DECIMAL POINT LOGIC AND CHARACTER POSITION COUNTER
U3470
3
5
(C-3 to C-7)
(R-7, R-10)
2
5
Y-SIGNAL TO VERTICAL AMPLIFIER
Y OUTPUT
Q3486
Q3493
(CHANNEL ADDRESS CODE)
(CHARACTER SCAN)
(R-1, R-2, R-4 R-5, R-6)
(ZERO-ADDING AND PREFIX-SHIFTING DATA)
8
5
CHARACTER GENERATOR (FIFTY CHARACTER MATRIX)
U3461, U3463
U3465, U3467
U3469
FORMAT GENERATOR
U3480
(READY)
COLUMN DECODER
U3418
10
10
(C-1 to C-10)
(CHARACTER POSITION)
X OUTPUT
Q3489
Q3499
ROW DECODER
U3429
8
X-SIGNAL TO HORIZONTAL AMPLIFIER

Fig. 3-27. (Cont.)

Time-Slot Counter. The Time-Slot Counter stage receives a trapezoidal voltage signal from the Timer stage and directs it to one of ten output lines. These output lines are labeled TS-1 through TS-10 (time-slots one through ten) and are connected to the vertical and horizontal plug-in compartments as well as to various stages within the Readout System. The output lines are energized sequentially, so there is a pulse on only one of the ten lines during any 250-microsecond timing period. After the Time-Slot Counter stage has counted time-slot 10, it produces an End-of-Word pulse which advances the system to the next channel.

Encoding the Data. Two output lines, row and column, are connected from each channel of the plug-in back to the Readout System. Data is typically encoded on these output lines by connecting resistors between them and the time-slot input lines. The resultant output is a sequence of ten analog current levels that range from zero to one milliampere (100 microamperes/step) on the row and column output lines. These row and column currents correspond to the row and columns of the Character Selection Matrix in Fig. 3-26. The standard format for encoding information onto the output lines is given in Table 3-1. Special-purpose plug-in units may have their own format for readout; these special formats are defined in the manuals for these units.

The encoded column and row data from the plug-in units is selected by the Column Data Switch and Row Data Switch stages respectively. These stages take the analog currents from the four data lines (two channels from each plug-in compartment) and produce a time-multiplexed analog voltage output containing all of the column or row information from the plug-ins. The Column Data Switch and Row Data Switch are sequenced by the binary Channel Address Code from the Channel Counter.

Display-Skip. The time-multiplexed output of the Column Data Switch is monitored by the Display-Skip Generator to determine if it represents valid information that should be displayed. Whenever information is not encoded in a time-slot, the Display-Skip Generator produces an output level that prevents the Timer stage from generating the control signals that normally interrupt the writing beam to produce a character.

Row and Column Decoder. The analog outputs of the Column Data Switch and Row Data Switch are connected to the Column Decoder and Row Decoder stages respectively. These stages sense the magnitude of the analog voltage input and produce an output current on one of ten lines.

The outputs of the Column Decoder stage are identified as C-1 through C-10 (column 1 through 10) corresponding to the encoded column information. Likewise, the outputs of the Row Decoder stage are identified as R-1 through R-10

TABLE 3-1

Standard Readout Format

Time-Slot Number	Description
TS-1	Determines decimal magnitude (number of zeros displayed or prefix change information) or the IDENTIFY function (no display during this time-slot).
TS-2	Indicates normal or inverted input (no display for normal).
TS-3	Indicates calibrated or uncalibrated condition of plug-in variable control (no display for calibrated condition).
TS-4	Scaling.
TS-5 TS-6 TS-7	Not encoded by plug-in unit. Left blank to allow addition of zeros by Readout System.
TS-8	Defines the prefix which modifies the units of measurement.
TS-9 TS-10	Define the units of measurement of the plug-in unit. May be standard units of measurement (V, A, S, etc.) or special units selected from the Character Selection Matrix.

@

(row 1 through 10) corresponding to the encoded row information. The primary function of the row and column outputs is to select a character from the Character Selection Matrix for the Character Generator stage. These outputs are also used at other points within the system to indicate when certain information has been encoded. One such stage is the Zeros Logic and Memory.

Zeros Logic and Memory. During time-slot 1 (TS-1), Zeros Logic and Memory checks if zero-adding or prefix-shifting information has been encoded by the plug-in unit. If so, the data is stored in an internal memory until time-slots 5, 6, or 8. After storing this information, it triggers the Display-Skip Generator stage so that there is no display during time-slot 1 (as defined by Standard Readout Format; see Table 3-1). When time-slots 5, 6, and 8 occur, the memory is addressed and any information stored there during time-slot 1 is transferred to the input of the Column Decoder stage to modify the analog data during the applicable time-slot.

Zeros Logic and Memory also produces the IDENTIFY function. When time-slot 1 is encoded for IDENTIFY (column 10, row 3), this stage produces an output level that connects the Column Data Switch and Row Data Switch to a coding network within the Readout System. Then, during time-slots 2 through 9, an analog current output is produced from the Column Data Switch and the Row Data Switch, addressing the

correct points in the Character Selection Matrix to write the word "IDENTIFY" on the target. The Zeros Logic and Memory stage is reset after each word by the Word Trigger pulse.

Character Generators. The Character Generator stages produce the characters which are written on the target. Any of the 50 characters shown in the Character Selection Matrix can be addressed by proper selection of the column and row currents. Only one character is addressable in any one time-slot.

A space can be added in the displayed word by the Decimal Point Logic and Character Position Counter stage when so encoded by the plug-in. This stage counts the number of characters generated and produces an output current to step the display one character position to the right for each character. In addition, the character position is advanced once during each of time-slots 1, 2, and 3, whether a character is generated during these time-slots or not. This action fixes the starting point of the standard-format display so that the first digit of the scale factor always starts at the same point within each word, regardless of the information encoded in the first three time-slots.

By encoding row 10 and column 0 during any time-slot, a blank space can be added to the display. Decimal points can be added to the display at any time by addressing the appropriate row and column address (See Character Selection Matrix for location of decimal points). The Decimal Point Logic and Character Position Counter stage is reset after each word by the Word Trigger pulse.

Format Generator. The Format Generator stage provides output signals to the R7912 vertical and horizontal deflection systems to produce the character display. The binary Channel Address Code from the Channel Counter is connected to this stage, so that the display from each channel is positioned in the area of the target associated with the plug-in and channel originating the word (see Fig. 3-25).

The positioning current or decimal point location current generated by the Decimal Point Logic and Character Position Counter stage is added to the Horizontal (X) signal at the input to the Format Generator stage to provide horizontal positioning of the characters within each word. The X- and Y-Readout signals are connected to the Horizontal Amplifier and Vertical Amplifier through the X- and Y-Buffer stages.

Word Trigger. The Word Trigger stage produces a trigger from the End-of-Word pulse generated by the Time-Slot Counter stage after the tenth time-slot. This Word Trigger pulse advances the Channel Counter to display the

information from the next channel or plug-in. It also provides a reset pulse to the Zeros Logic and Memory stage and to the Decimal Point Logic and Character Position Counter stage. The Word Trigger stage can also jump a complete word or a portion of a word when a Jump command is received from the Row Data Switch stage.

Single-Shot Lockout. The Single-Shot Lockout stage allows the display timing of the Readout System to be changed. Normally, the Readout System operates in a free-running mode, interrupting the waveform display at random to display characters. Under certain conditions, however, it is desirable that the Readout System operate in a triggered mode. In this mode, the readout portion of the display is presented only on command. The Readout Mode switch, located on the Read Gun Supply board and shown on Schematic 2, determines the operating mode of the Readout System.

Detailed Description

The following discussion describes the Alphanumeric Readout System in detail. Diagram 19 is a complete schematic of the system, and it should be unfolded for easy reference.

Timer. Timer U3433 establishes the timing sequence for all circuits within the Readout System. This stage produces seven time-related output waveforms (see Fig. 3-28). The

triangle waveform produced at pin 6 forms the basis for the remaining signals. The basic period of this triangle waveform is about 250 microseconds as controlled by RC network R3434-C3434. The triangle waveform is clipped and amplified by U3433 to form the trapezoidal output signal at pin 10. The amplitude of the output signal is exactly 15 volts as determined by the Timer (exact amplitude is necessary to accurately encode data in plug-in units; see Encoding the Data). The Trigger output at pin 5 provides the switching signal for the Time-Slot Counter and Word Trigger stages.

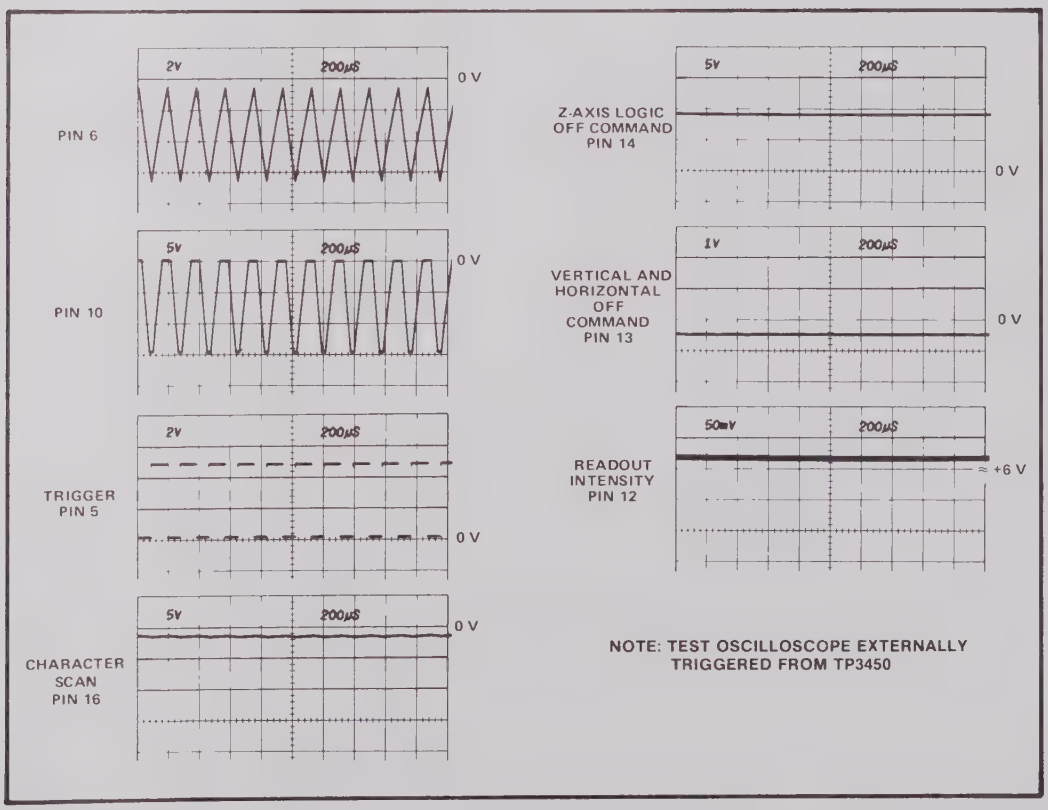


Fig. 3-28. Timer output waveforms.

The signals at pins 12, 13, 14, and 16 are produced only when the triangle waveform is on its negative slope and the trapezoidal waveform has reached its lowest level. The timing sequence of these waveforms is important to the operation of the Readout System (see expanded waveforms in Fig. 3-29). the Z-Axis Inhibit Command at pin 14 is produced first. This negative-going signal provides a blanking pulse to the Z-Axis Logic stage to blank the writing beam before the display is switched to the Readout System. It also produces a Strobe pulse through Q3442 and CR3442 to signal other stages within the Readout System to begin producing a character.

The collector level of Q3442 is also connected to Character Generator No. 2 (U3463) through CR3443. This activates U3463 during the quiescent period of the Strobe pulse (collector of Q3442 negative) and diverts the output current of Row Decoder U3429 to row 2. The purpose of this configuration is to prevent the Zeros Logic and Memory stage (U3401) from storing incorrect data during the quiescent period of the Strobe pulse. When the Strobe pulse goes positive, CR3433 is reverse-biased to disconnect Q3442 from U3463 and allow the Row Decoder to operate in the normal manner.

The next signal to be produced is the Vertical and Horizontal Inhibit Command at pin 13. This positive-going signal disconnects the plug-in signals from the vertical

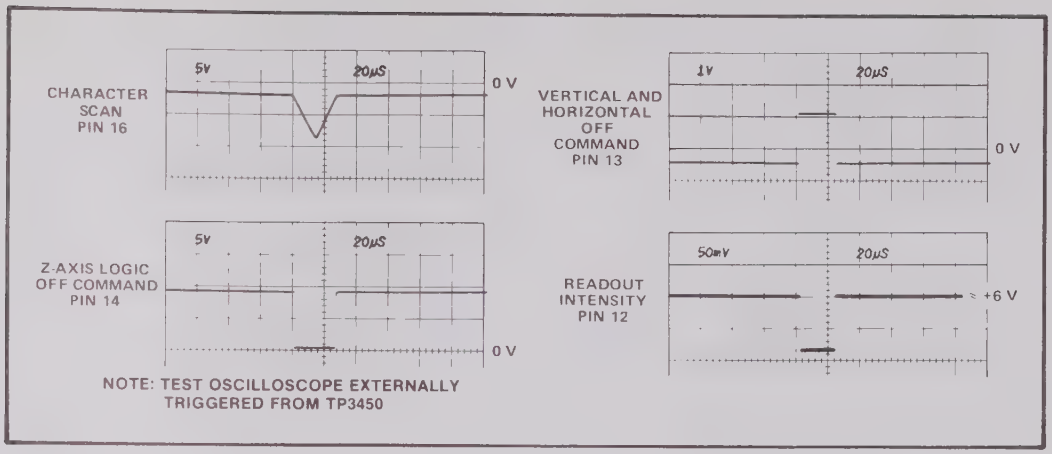


Fig. 3-29. Expanded timer waveforms.

and horizontal deflection systems, so the plug-in units cannot control the position of the writing beam during the readout display. The Ready signal derived from this output is connected to the Decimal Point Logic and Character Position Counter stage and to the Format Generator stage.

The Readout Intensity output at pin 12 is produced next. This current is connected to the Z-Axis circuit to unblank the Scan Converter to the intensity level determined by the READOUT intensity control. The Character Scan ramp at pin 16 starts to go negative as this timing sequence begins. However, character generation does not start until the readout intensity level has been established. The triangular Character Scan ramp runs from about -2 volts to about -8.5 volts, then returns back to the original level. This waveform provides the scanning signal for the Character Generator stages. Character Scan adjustment R3437 sets the DC level of the Character Scan ramp to provide com-

plete characters on the display.

The Timer stage operates in one of two modes as controlled by the Display-Skip level at pin 4. The basic mode just described is a condition that does not occur unless all ten characters of each word (40 characters total) are written on the target. Under typical conditions only a few characters are displayed in each word. The Display-Skip level at pin 4 determines the period of the Timer output signal. When a character is to be generated, pin 4 is LO and the circuit operates as just described. However, when a character is not to be displayed, a HI level is applied to pin 4 of the Timer through CR3432 from the Display-Skip Generator stage. This signal causes the Timer to shorten its period of operation to about 210 microseconds. The waveforms in Fig. 3-30 show the operation of the Timer stage when the Display-Skip condition occurs for all positions in a word.

Notice that there is no output at pins 12, 13, 14, and 16 under this condition. This means that the writing beam is not interrupted to display characters. Also notice that the triangle waveform at pin 6 does not go as far negative, and that the negative portion of the trapezoidal waveform at pin 10 is shorter. Complete details on operation of the Display-Skip Generator are given later.

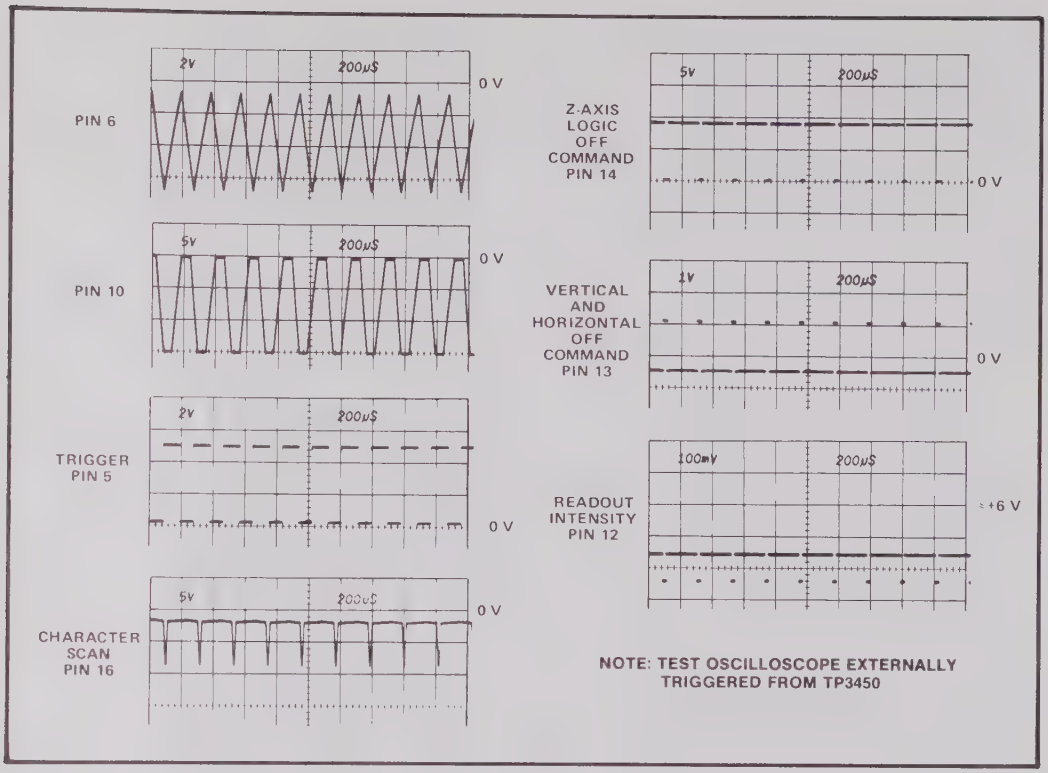


Fig. 3-30. Timer outputs during Display-skip.

The Timer operation is also controlled by the Single-Shot Lockout level at pin 2. If this level is LO, the Timer operates as just described. However, if the Single-Shot Lockout stage sets a HI level at this pin, the Timer stage is locked out and can not produce any output signals (see Single-Shot Lockout description for further information).

The READOUT intensity control (Diagram 2) sets the intensity of the readout display and provides a means of turning the Readout System off when a readout display is not desired. When the control is turned fully counterclockwise, a switch in series with the Readout Intensity line

opens. The current to pin 11 of the Timer is interrupted, and at the same time, a positive voltage is applied to pin 4 through CR3431. The positive voltage switches the stage to the Display-Skip condition, and the writing beam is not interrupted to generate characters. Time-slot pulses continue to be generated, however.

Time-Slot Counter. Time-Slot Counter U3445 is a sequential switch that directs the trapezoidal waveform input at pin 8 to one of its 10 output lines. These time-slot pulses are used to interrogate the plug-in units to obtain data for the Readout System. The Trigger pulse at pin 15 switches the Time-Slot Counter to the next output line; the output signal is sequenced consecutively from time-slot 1 through time-slot 10. Figure 3-31 shows the time relationship of the time-slot pulses. Notice that only one line carries a time-slot pulse at any given time. When time-slot 10 is completed, a negative-going End-of-Word pulse is produced at pin 2. The End-of-Word pulse provides a drive pulse for the Word Trigger stage and also provides an enabling level to the Display-Skip Generator for time-slot 1.

Pin 16 is a reset input for the Time-Slot Counter. When this pin is held LO, the Time-Slot Counter resets to time-slot 1. The Time-Slot Counter can be reset in this manner only when a Jump Command is received by U3447A and B (see following discussion).

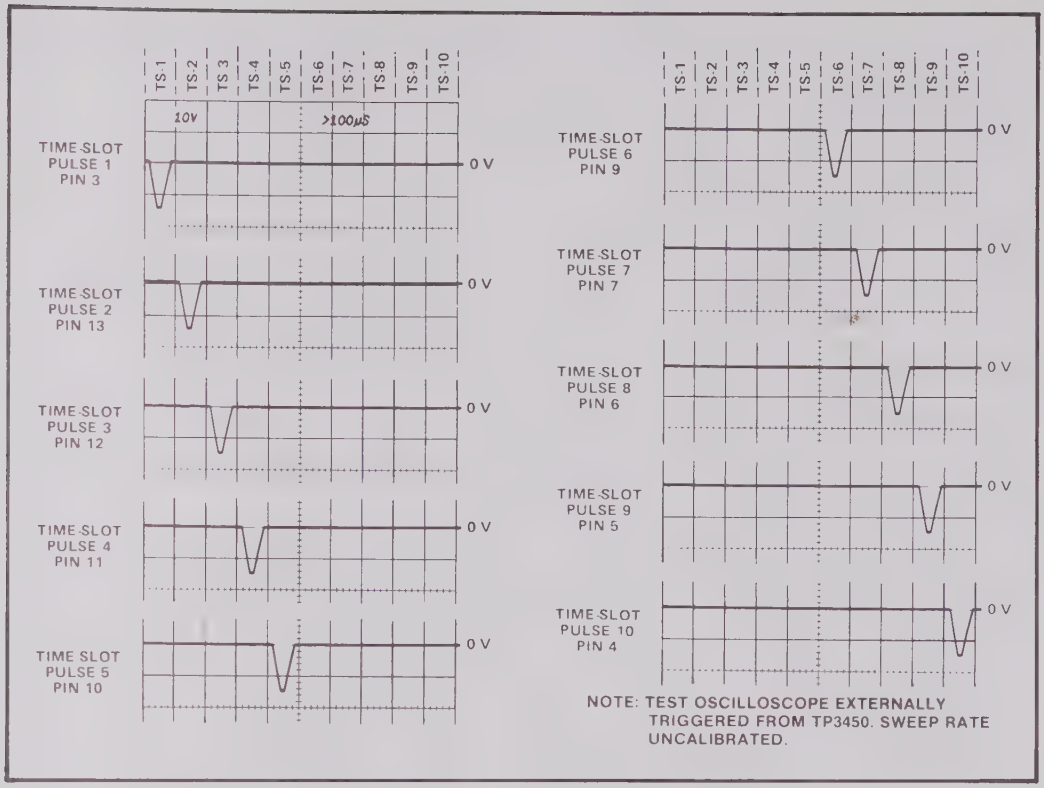


Fig. 3-31. Time-slot pulses.

Word Trigger. The Word Trigger stage is made up of U3447C and D. Quiescently, pin 3 of U3447C is LO as established by the operating conditions of U3447A and B. Therefore, the LO End-of-Word pulse produced by the Time-Slot Counter results in a HI level at pin 10 of U3447C. This level is inverted by U3447D to provide a negative-going Word Trigger pulse to the Channel Counter.

Also, a Word Trigger pulse is produced by U3447D when a Jump Command is received at pin 5 of U3447B. This condition can occur during any time-slot (see Row Decoder for further information on origin of the Jump Command). U3447A and B are connected as a bistable flip-flop. The positive-going Jump Command at pin 5 of U3447B produces a LO at pin 4. This LO is inverted by U3447A to produce a HI at pin 1, which allows pin 6 to be pulled HI through CR3447.

The flip-flop has now been set and remains in this condition until reset, even though the Jump Command at pin 5 returns to its LO level. The HI output level at pin 1 turns on Q3445 to pull pin 16 of the Time-Slot Counter LO. This resets the Time-Slot Counter to time-slot 1 and holds it there until the Word Trigger is reset. At the same time, a HI level is applied to pin 4 of the Timer through CR3445 and CR3432. This HI level causes the Timer to operate in the Display-Skip mode, so a character is not generated.

The next Trigger pulse is not recognized by the Time-Slot Counter, since it is locked in time-slot 1 by U3447. However, this Trigger pulse resets the Word Trigger stage through C3445. Pin 1 of U3447A goes LO to enable the Time-Slot Counter and Timer stages for the next time-slot pulse. Simultaneously, when U3447A switches output states, the resulting negative-going edge is connected to pin 8 of U3447C. This results in a negative-going Word Trigger output at pin 13 to advance the Channel Counter to the next

word. When the next Trigger pulse is received at pin 15, the Time-Slot Counter returns to the normal sequence of operation and produces an output on the time-slot 1 line.

Channel Counter. Channel Counter U3450 is a binary counter that produces the Channel Address Code for the Column and Row Decoder stages and the Format Generator stage. This code instructs the stages to sequentially select and display the four channels of data from the plug-ins. Table 3-2 gives the four combinations of the Channel Address Code and the channel selected with each combination.

Readout Control. The front-panel Readout Mode circuitry (Schematic 2) controls the operating mode of the Readout System. A switch in that circuit allows operation in either a Free Run or a Gate Trig'd mode. The free run mode allows the Readout to run continuously, time-sharing the writing beam whenever necessary to write characters.

The Gate Trig'd mode locks out the Readout System until the end of a normal or single sweep. The Readout is generated only once in single-sweep mode.

The enabling signal for the Readout System enters Schematic 19 at the upper left. The R-S flip-flop formed by U3449C and D makes up the Single-Shot Lockout stage.

TABLE 3-2

Channel Address Code

Pin 11 U3450	Pin 8 U3450	Pin 9 U3450	Channel Displayed
LO	LO	LO	Channel 2 Vertical
LO	LO	HI	Channel 1 Vertical
HI	HI	LO	Channel 2 Horizontal
HI	HI	HI	Channel 1 Horizontal

Single-Shot Lockout. The Single-Shot Lockout stage allows a single readout frame (four complete words) to be written on the target, after which the Readout System is locked out. Further readout displays are not presented until the circuit is reset. U3449C and D are connected to form a bistable flip-flop. For free-run operation, pin 8 of U3449C is pulled HI through R3449. This results in a LO output level at pin 10, enabling the Timer stage to operate in the free-running manner described previously.

The output of the Single-Shot Lockout stage remains LO until a LO is received at pin 8 of U3449C. When this occurs, the output level at pin 10 does not change immediately. However, the Readout System is now enabled as far as the single-shot lockout function is concerned. If the Channel Counter has not completed word four (Channel 2 of HORIZ unit), the Readout System continues to operate in the normal manner. However, when word four is completed, the negative-going End-of-Frame pulse is produced at pin 11 of U3450 as the Channel Counter shifts to the code necessary to display word one. This pulse is coupled to pin 12 of U3449D. The momentary HI at pin 12 activates the gate and its output stage goes LO to disable U3449C (pin 8 already LO). The output goes HI to disable the Timer, so it operates in the Display-Skip mode. The HI at pin 10 of U3449C also holds U3449D enabled, so it maintains control of the flip-flop.

The Single-Shot Lockout stage remains in this condition until a positive-going trigger pulse is applied to pin 8 of U3449C. This trigger pulse produces a LO at pin 10 to enable the Timer and disable U3449D. Now the Timer operates in the normal manner for another complete frame. When word four is completed, the Channel Counter produces another End-of-Frame pulse to again lock out the Timer stage. (For further information on the Readout Mode, see the Readout Control description.)

Encoding the Data. Data is conveyed from the plug-in units to the Readout System in the form of an analog (current level) code. The characters that can be selected by the encoded data are shown on the Character Selection Matrix (Fig. 3-26).

Each character requires two currents to define it; these currents are identified as the column current and the row current, corresponding to the column and row of the matrix. The column and row data is encoded by a resistor network in the plug-in units. Figure 3-32 shows a typical encoding scheme using resistors for a voltage-sensing amplifier plug-in unit. Notice that the 10 time-slot (TS) pulses produced by the Time-Slot Counter stage are connected to the plug-in unit. However, time-slots 5, 6, 7, and 10 are not normally used by this plug-in when using the Standard Readout Format. (See Table 3-1 for Standard Readout Format.) The amplitude of the time-slot pulse is exactly -15 volts as determined by the Timer stage. Therefore, the resultant output current from the plug-in units is determined by the programming resistors in the plug-in units.

For example, in Fig. 3-32 resistors R10 through R90 control the row analog data, which is connected back to the Readout System. Figure 3-33 shows an idealized output current waveform of row analog data, which results from the time-slot pulses. Each of the row levels of current shown in these waveforms corresponds to 100 microamperes of cur-

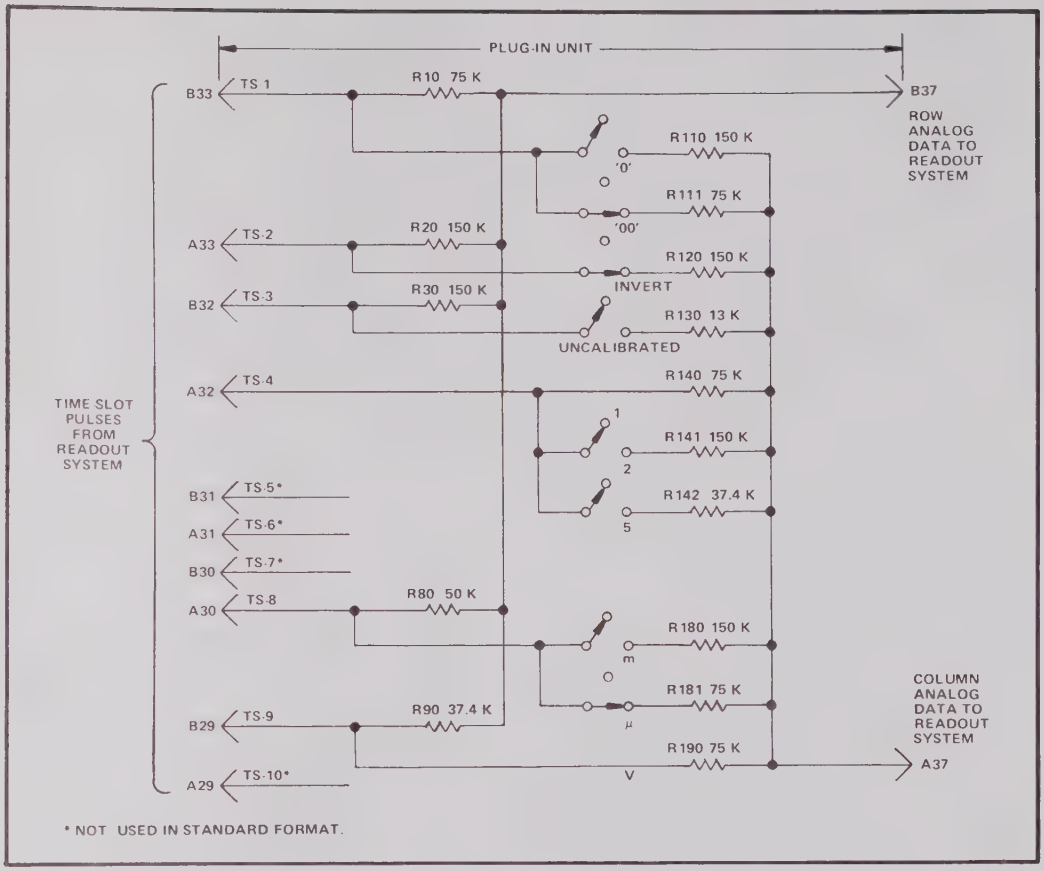


Fig. 3-32. A typical readout encoding scheme.

rent. The row numbers on the left-hand side of the waveform correspond to the rows in the Character Selection Matrix.

The Column analog data is defined by resistors R110 through R190. The program resistors are connected to the time-slot lines by switch closures to encode the desired data. The data as encoded by the circuit shown in Fig. 3-32 indicates a 100-microvolt sensitivity with the waveform display inverted and calibrated deflection factors. This results in the idealized output current waveforms shown in Fig. 3-33 at the column analog data output.

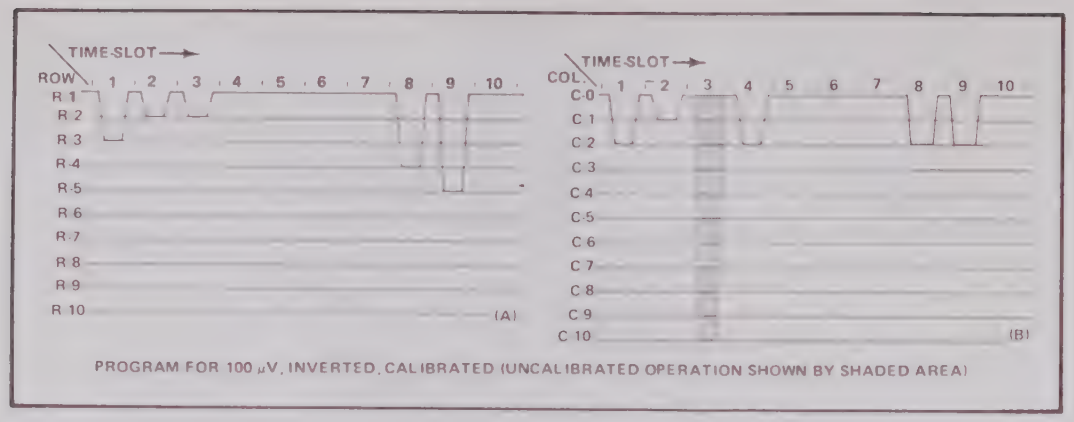


Fig. 3-33. Idealized output currents.

Resistor R111, connected between time-slot 1 and the column analog data output, encodes two units of current during time-slot 1. Referring to the Character Selection Matrix, two units of column current, along with the two units of row current encoded by resistor R10 (row 3), indicates that two zeros should be added to the display. Resistor R120 adds one unit of column current during time-slot 2 and, along with the one unit of current from the row output, the Readout System is instructed to add an invert arrow to the display. Resistor R130 is not connected to the time-slot 3 line since the deflection factor is calibrated. Therefore, there is no column current output during this time-slot and no characters written on the target. (See Display-Skip Generator for further information.)

During time-slot 4, two units of column current are encoded by R140. There is no row current encoded during this time-slot, resulting in the numeral 1 being written on the target. Neither row nor column analog data is encoded during time-slots 5, 6, and 7 as defined by the Standard Readout Format. During time-slot 8, two units of column current and three units of row current are encoded by resistors R181 and R80, respectively. This addresses the μ prefix in the Character Selection Matrix.

The final data output is provided from time-slot 9 by R190 connected to the column output and R90 to the row output. These resistors encode two units of column current and four units of row current to cause a V (volts) to be displayed. Time-slot 10 is not encoded, in accordance with the Standard Readout Format. The resultant readout will be + 100 μ V.

In the above example, the row analog data was programmed to define which row of the Character Selection Matrix was addressed to obtain information in each time-slot. The column data changes to encode the applicable readout data as the operating conditions change. For example, if the variable (uncalibrated) control of the plug-in unit was activated, R130 would be connected between time-slot 3 and the column analog data output line. This encodes 10 units of column current (shaded area in time-slot 3 of the waveform shown in Fig. 3-33). Since one unit of row

current is also encoded during this time-slot by R30, a > symbol is added to the display. The CRT readout will now show +>100 μ V. In a similar manner, the other switches can change the encoded data for the column output and thereby change the readout display.

The column analog data encoded by most plug-in units can be modified by attenuator probes connected to the input connectors of amplifier plug-in units. A special coding ring around the input connector of the plug-in unit senses the attenuation ratio of the probe (with readout-coded probes only).

The probe contains a circuit that provides additional column current. For example, if a 10X attenuator probe is connected to a plug-in unit encoded for 100 microvolts as shown in Fig. 3-32, an additional unit of current is added to the column analog data during time-slot 1. Since two units of current were encoded by R111, this additional current results in a total of three units of column analog current during this time-slot. Referring to the Character Selection Matrix, three units of column current, along with the two units of row current encoded by R10, indicates that the prefix should be shifted one column to the left. Since this instruction occurs in the same time-slot that previously added two zeros to the display, and since only one instruction can be encoded during a time-slot, the zeros do not appear in the display. The readout is now changed to 1

mV (readout program produced by plug-in same as for previous example).

The preceding information was a typical example of encoding data from an amplifier plug-in unit. Specific encoding data and circuitry is shown in the individual plug-in unit manuals.

Column and Row Data Switches. The encoding data from the plug-in units is connected to the Column and Row Data Switch stages. A column-data line and a row-data line convey analog data from each of the four data sources (two channels from each of the two plug-in compartments).

The Column Data Switch U3372 and the Row Data Switch U3362 receive the Channel Address Code from the Channel Counter. This binary code directs the Column Data Switch and the Row Data Switch to the correct plug-in channel. Table 3-2 gives the four valid combinations of the Channel Address Code and the resultant channel selected with each combination. These stages have five inputs and provide a time-multiplexed output at pin 7, which includes the information from all of the input channels. Four of the five inputs to each stage originate in the plug-in units; the fifth input comes from a special data-encoding network (bottom left corner of the schematic) composed of resistors R3378 through R3399. (See Zeros Logic and Memory description for further information on fifth channel.)

Row Match adjustment R3422 (center of schematic) sets the gain of the Row Data Switch to match the gain of the Row Decoder for correct output. Column Match adjustment R3407 performs the same function for the Column Data Switch stage.

Display-Skip Generator. The Display-Skip Generator is made up of Q3406, Q3411, Q3416, and Q3414. This stage monitors the time-multiplexed column data at the output of the Column Data Switch during each time-slot. It determines whether or not the information present is valid data that should result in character generation. Quiescently, there is about 100 microamperes of current flowing through R3409 from Q3419 and the Zeros Logic and Memory stage. This current biases Q3406A so that in the absence of column data,its base is about 0.2 volt more positive than the base of Q3406B. Since Q3406A and Q3406B are connected as a comparator, Q3406A remains on unless its base is pulled more negative than the base of Q3406B.

The analog data output from the Column Data Switch produces about 0.5-volt change for each unit of encoded column current. Whenever any information appears at the output of the Column Data Switch, the base of Q3406A is pulled more negative than the base of Q3406B, resulting in a negative (LO) Display-Skip output through Q3416 to the Timer stage. Recall that a LO is necessary at the skip input of the Timer so it can perform the complete sequence necessary to

display a character.

Q3411 and Q3414 also provide Display-Skip action. The End-of-Word level connected to their emitters is LO only during time-slot 1. This means they are enabled only during this time-slot. These transistors allow the Zeros Logic and Memory stage to generate a Display-Skip signal during time-slot 1. Information that is not to be written on the target is stored in memory during this time-slot (further information is given under Zeros Logic and Memory).

Column and Row Decoders. Column Decoder U3418 and Row Decoder U3429 sense the magnitude of the analog voltages at their inputs (pin 10) and produce a binary output on one of ten lines corresponding to the column or row data encoded by the plug-in unit. These outputs provide the Column Digital Data and Row Digital Data, which is used by the Character Generator stages to select the desired character. The column and row data is also used throughout the Readout System to perform other functions.

The input current at pin 9 of the Column Decoder stage is steered to one of the ten Column Digital Data outputs. When a Display-Skip signal is present (collector of Q3416 HI), pin 9 is pulled HI through CR3416. The HI ensures that no current is supplied to the Character Generator stage under this condition. Notice the corresponding input on the Row Decoder. This input is connected to ground and causes one of the ten row outputs to saturate to ground.

The network at the input of the Row Decoder, made up of Q3427 and its associated components, is a Row-14 detector that produces the Jump Command. This row current is encoded by special-purpose plug-ins to cause all or part of a word to be jumped. Whenever row 14 (thirteen units of row current, or 1.3 milliamperes) is encoded, the base of Q3427 is pulled negative, producing a HI Jump Command output at its collector. The Jump Command is connected to the Word Trigger stage to advance the Channel Counter to the next word. It also resets the Time-Slot Counter to time-slot 1.

Zeros Logic and Memory. The Zeros Logic and Memory stage (U3401) stores data encoded by the plug-in units to provide zeros-adding and prefix-shifting logic for the Readout System. The Strobe pulse at pin 15 goes positive when the data has stabilized and can be inspected. This activates the Zeros Logic and Memory stage so that it can store the encoded data. A block diagram of the memory is shown in Fig. 3-34.

Typical output waveforms for the five possible input conditions that can occur are shown in Fig. 3-35. When time-slot 1 occurs, a store command is given to all of the memories. If a plug-in unit encodes data for column 1, 2, 3, 4, or 10 during time-slot 1, the appropriate memory (or memories) is set. Notice that row 3 information from the Row Decoder must also be present at pin 16 for data to be

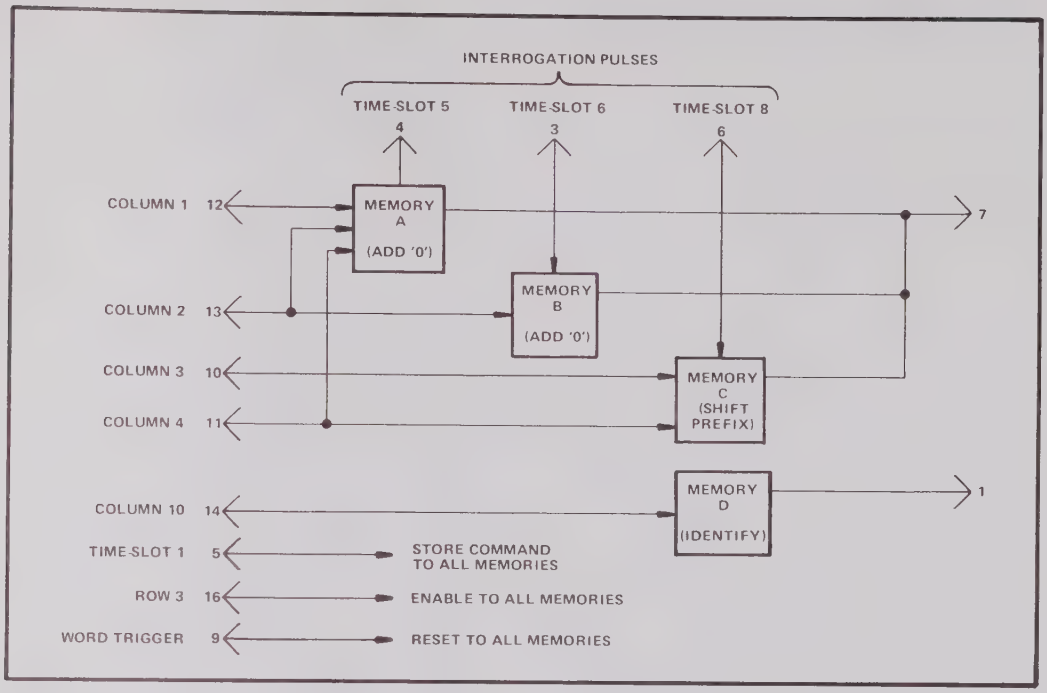


Fig. 3-34. Zeros Logic and Memory block diagram.

stored in the memory.

If data is encoded during time-slot 1, a negative-going output is produced at pin 7 while the memories are being set. This negative-going pulse is connected to the base of Q3414 in the Display-Skip Generator to produce a Display-Skip output. Since the information encoded during time-slot 1 is only provided to set the memories and not intended to be written on the target at this time, the Display-Skip output prevents a readout display.

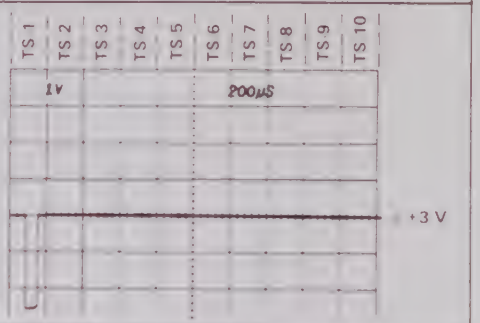
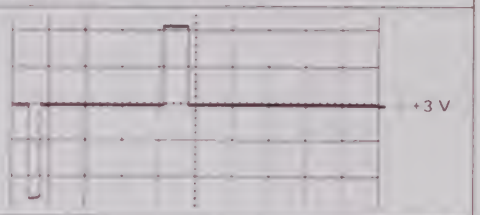
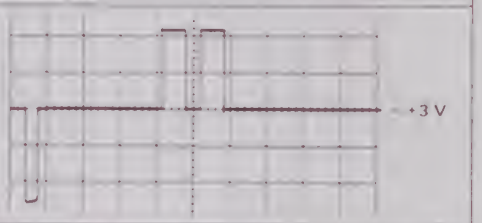
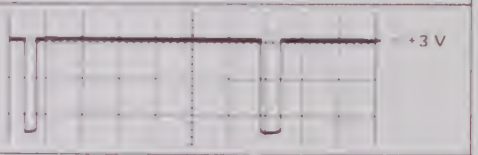
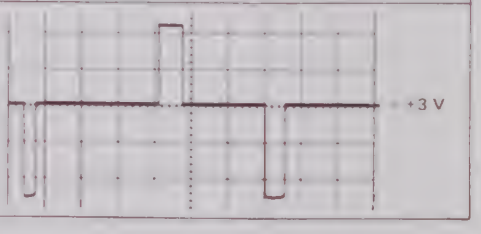
INPUT PIN OF U2232 ACTIVATED	COMMAND	TIME-SLOTS
14	IDENTIFY	
12	ADD ONE ZERO	
13	ADD TWO ZEROS	
10	DECREASE PREFIX	
11	DECREASE PREFIX AND ADD ONE ZERO	

Fig. 3-35. Input logic and Memory output waveforms.

During time-slot 5, memory A is interrogated. If information was stored in this memory, a positive-going output is produced at pin 7. This pulse is connected to pin 10 of the Column Decoder through Q3419 to add one unit of current at the input of the Column Decoder. This produces a zero after the character generated during time-slot 4. During

time-slot 6, memory B is interrogated to see if another zero should be added. If another zero is necessary, a second positive output is produced at pin 7, which again results in a column 1 output from the Column Decoder and adds a second zero to the display.

Finally, memory C is interrogated during time-slot 8 to obtain information on whether the prefix should be changed, or left at the encoded value. If data has been encoded that calls for a shift in prefix, a negative-going output level is produced at pin 7. This negative level subtracts one unit of column current from the data at the input to the Column Decoder. Notice in the Character Selection Matrix (Fig. 3-26) that when row 4 is programmed, a reduction of one column results in a one-column shift of the prefix. For example, with the 100 μ V program shown in Fig. 3-32, if the data received from the plug-in called for a shift in prefix, the readout would be changed to 1 mV (zeros deleted by program; see Encoding the Data).

The 100 microamperes of quiescent current through R3409 provided by Q3419 (see Display-Skip Generator) allows the prefix to be shifted from "m" (column 1) to no prefix (column zero) so only the unit of measurement encoded during time-slot 9 is displayed. Notice that reducing the prefix program from column 1 to column 0 programs the Readout System to skip a character at this readout location.

A further feature of the Zeros Logic and Memory is the identify function. If 10 units of column current are encoded by the plug-in unit along with row 3 during time-slot 1, the Zeros Logic and Memory produces a negative-going output pulse at pin 1 to switch the Column Data Switch and Row Data Switch to the ninth channel. Then, time-slot pulses 2 through 9 encode an output current through resistors R3378-R3399 for column and row data. This provides the currents necessary to display the word IDENTIFY in the word position allotted to the channel originating the Identify command. After completion of this word, the Column Data Switch and Row Data Switch continue with the next word in sequence.

The Word Trigger signal from the Word Trigger stage is connected to pin 9 of Zeros Logic and Memory through C3401. At the end of each word of readout information, this pulse goes LO. This erases the four memories in the Zeros Logic and Memory in preparation for the data to be received from the next channel.

Character Generators. The Character Generator stage consists of five similar integrated circuits (U3461 through U3469, top of schematic) which generate the X (horizontal) and Y (vertical) outputs at pins 16 and 1, respectively, to produce the character display. Each integrated circuit can produce 10 individual characters. U3461 (designated "Numerals") can produce the numerals 0 through 9 as shown in row

1 of the Character Selection Matrix. U3463 can produce the symbols shown in row 2 of the Character Selection Matrix and U3465 produces the prefixes and some letters used as prefixes shown in row 4. U3467 and U3469 produce the remaining letters shown in rows 5 and 6 of the Character Selection Matrix.

All of the Character Generator stages receive the Column Digital Data from the Column Decoder in parallel. However, only one of the Character Generators receives row data at a particular time, and only the stage receiving this row data is activated. For example, if column 2 is encoded, the five Character Generators are enabled so that either a 1, <, μ, V, or an N can be produced. If row 4 has been encoded at the same time, only the Prefix Character Generator U3465 will produce an output to result in a "μ" being displayed. The activated Character Generator provides current output for the Format Generator to produce the selected character on the target. In a similar manner, any of the characters shown in the Character Selection Matrix can be displayed by correct addressing of the row and column.

Character Position Counter. Decimal Point Logic and Character Position Counter U3470 performs two functions. The first function is to add a staircase current to the X (horizontal) signal to space the characters horizontally on the target. After each character is generated, the negative-going edge of the Ready signal at pin 5 advances

the Character Position Counter. This produces a current step output at pin 3 which, when added to the X signal, causes the next character to be displayed one character space to the right. This stage can also be advanced when a Space instruction is encoded, leaving a space between the displayed characters. Row 10 information from the Row Decoder is connected to pin 4 of U3470. When row 10 and column 0 are encoded, the output of this stage advances one step, moving the next character another space to the right. No display is produced during this time-slot since the Character Generators are not activated.

Time-slot pulses 1, 2, and 3 are also connected to pin 4 of U3470 through VR3470, VR3471, and VR3472 respectively. This configuration adds a space to the displayed word during time-slots 1, 2, and 3, even if no information is encoded for display during these time-slots. With this feature, the information displayed during time-slot 4 (scale factor data) always starts in the fourth character position whether data has been displayed in the previous time-slots or not. Therefore, the resultant CRT display does not shift position as normal-invert or cal-uncal information is added. The Word Trigger pulse connected to pin 8 resets the Character Position Counter to the first character position at the end of each word.

Decimal Point Logic. The Decimal Point Logic portion of this stage allows decimal points to be added to the display. With the Standard Readout Format, row 7, encoded coincident with columns 3 through 7, addresses a decimal at one of the five locations identified in row 7 of the Character Selection Matrix. This instruction refers to the decimal point location in relation to the total number of characters possible in one word (see Fig. 3-36). For example, column 3 encoded with row 7 during time-slot 1 places a decimal point in location No. 3. As shown in Fig. 3-36, this displays a decimal point after the third possible character position in a word.

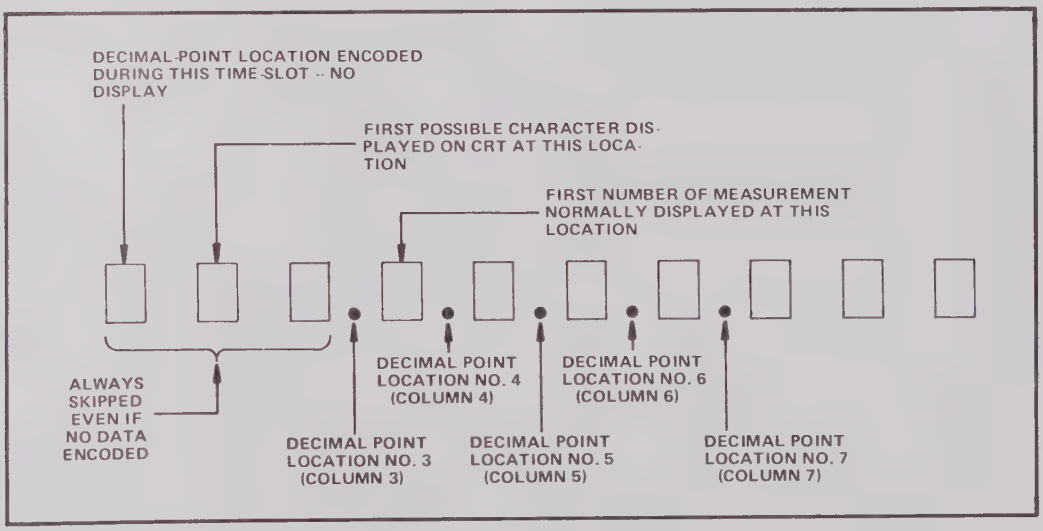


Fig. 3-36. Decimal point positioning.

When decimal-point data is encoded, the writing gun is unblanked, and a readout display is presented. Since row 7 does not activate any of the five Character Generators, the writing beam is deflected vertically by row-7 data applied through R3479 to the Y input of the Format Generator. This

places the decimal point between the characters along the bottom line of the readout word. After the decimal point is produced in the addressed location, the CRT beam returns to the location indicated by the Character Position Counter to produce the remainder of the display.

Format Generator. The X- and Y- deflection signals produced by the Character Generator stage are connected to pins 2 and 7, respectively, of Format Generator U3480. The Channel Address Code from the Channel Counter is also connected to pins 1, 8, and 15 of this stage. The Channel Address Code directs the Format Generator to add current to the X and Y signals, deflecting the writing beam to the proper target area for the originating plug-in channel. The Ready signal at pin 13 (coincident with the Vertical and Horizontal Inhibit Command output) activates the stage whenever a character is to be written. R3466 and R3468 determine the horizontal and vertical size, respectively, of the displayed characters. The character position current from the Decimal Point Logic and Character Position Counter stage is added to the X input signal to horizontally space the characters on the target.

Y-Output Amplifier. The Y-output signal at pin 6 of Format Generator U3480 is connected to the Y-Output Amplifier Q3486-Q3493. This stage provides a low-impedance load for the Format Generator while providing isolation between the Readout System and the driven circuits. Vertical Separa-

tion adjustment R3490 changes stage gain to control the vertical separation between readout words displayed at the top and bottom of the graticule area.

X-Output Amplifier. The X-Output Amplifier Q3489-Q3499 operates like the Y-Output Amplifier, providing horizontal deflection from the readout signal available at pin 4 of U3480.

Display Sequence. Figure 3-37 shows a flow chart for the Readout System. This chart illustrates the sequence of events occurring in the Readout System each time a character is written on the target.

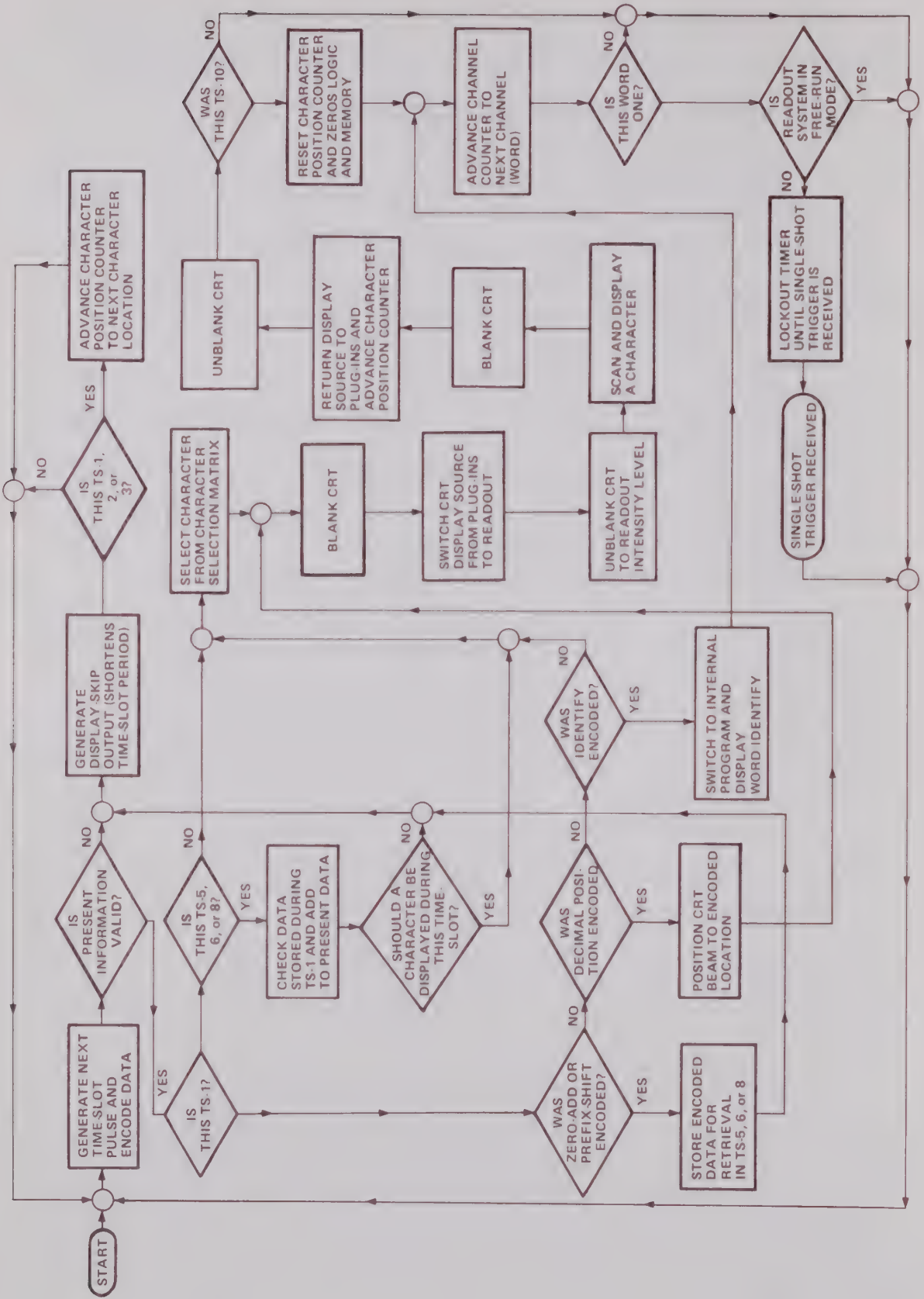


Fig. 3-37. Readout system flow chart.

READOUT TO ASCII CONVERTER

(Option 20)

Introduction

Description

The Readout (RO) to ASCII Converter circuit converts Tektronix analog knob-readout data to ASCII format. The ASCII encoded data is made available at the 104 pin connector on the rear panel. For detailed information concerning pin connections, refer to Diagram 22.

Data is presented in 7-bit words, bit parallel and word serial. The entire data field includes 32 words in four channels, each channel including eight 7-bit characters. Data appears right justified, with unused characters sent as ASCII spaces. Data output levels are TTL, with LOW the significant state.

Control Logic Sequence

Control of the RO to ASCII Converter requires several command signals. Flags are provided to indicate the operational state of the circuit during knob data acquisition and readout. The command signal sequence and the significance of the related flag signals are detailed below. A timing diagram of the command signal sequence is given in Fig. 3-38.

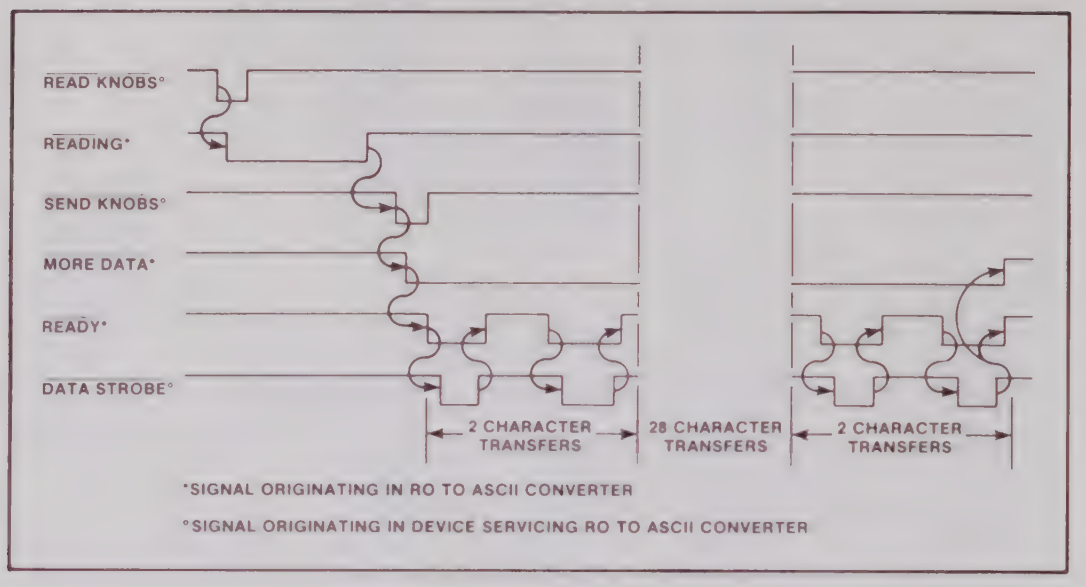


Fig. 3-38. Command timing.

1. $\overline{\text{READ KNOBS}}$ - A negative going 100-500 nanosecond pulse that initiates knob data acquisition. The RO to ASCII Converter typically requires 9 milliseconds to acquire and store knob readout data.

2. While the circuit is acquiring data, $\overline{\text{READING}}$ will be held low as a flag to the commanding device.

3. When $\overline{\text{READING}}$ is released, the circuit has all data in memory, and the READ cycle is complete.

4. A $\overline{\text{SEND KNOBS}}$ Command (100-150 nanosecond negative-going pulse) enables the RO to ASCII Converter to transmit the stored data.

5. $\overline{\text{MORE DATA}}$ goes low to indicate that data is available from the Converter memory.

6. $\overline{\text{RO READY}}$ is a flag to indicate that data is available at the output gates of the RO to ASCII Converter.

7. $\overline{\text{DATA STROBE}}$ is a negative going pulse that enables the output gates of the RO to ASCII Converter. When $\overline{\text{DATA STROBE}}$ goes high, the data is removed from the outputs and $\overline{\text{RO READY}}$ goes high. The RO to ASCII Converter readies the next character for readout. When the data is available, $\overline{\text{RO READY}}$ goes low. Typical time from rising edge of $\overline{\text{DATA STROBE}}$ to falling edge of $\overline{\text{RO READY}}$ is 10.5 microseconds $\pm$ 10%. $\overline{\text{DATA STROBE}}$ pulse separation must be at least 10.5 microseconds.

8. When all 32 characters have been read from memory, $\overline{\text{MORE DATA}}$ is released. Typical time to output all data is 336 microseconds $\pm$ 10%.

RO to ASCII Conversion with R7912/CP Bus Interface

Several functions are provided for automatic control of the RO to ASCII Converter when used with the R7912/CP Bus Interface. The $\overline{\text{READ KNOBS}}$ cycle is automatically initiated by the rising edge of the LOAD ENABLE signal from the R7912. $\overline{\text{MORE DATA}}$ and $\overline{\text{RO READY}}$ flags are used to generate CP-Bus flags for the controlling device. The $\overline{\text{SEND KNOBS}}$ command is automatically issued after all data has been read from the R7912 main memory. Further $\overline{\text{READ KNOBS}}$ com-

mands are inhibited until all data is read from the Converter memory. $\overline{\text{DATA STROBE}}$ pulses must be supplied from the controlling device. The timing constraint on $\overline{\text{DATA STROBE}}$ pulses (10.5-microsecond minimum delay between pulses) is not affected by the interface. Provision has been made for inhibiting knob readout when desired. A timing diagram of Readout to ASCII control signals using the R7912/CP Bus Interface is given in Fig. 3-39.

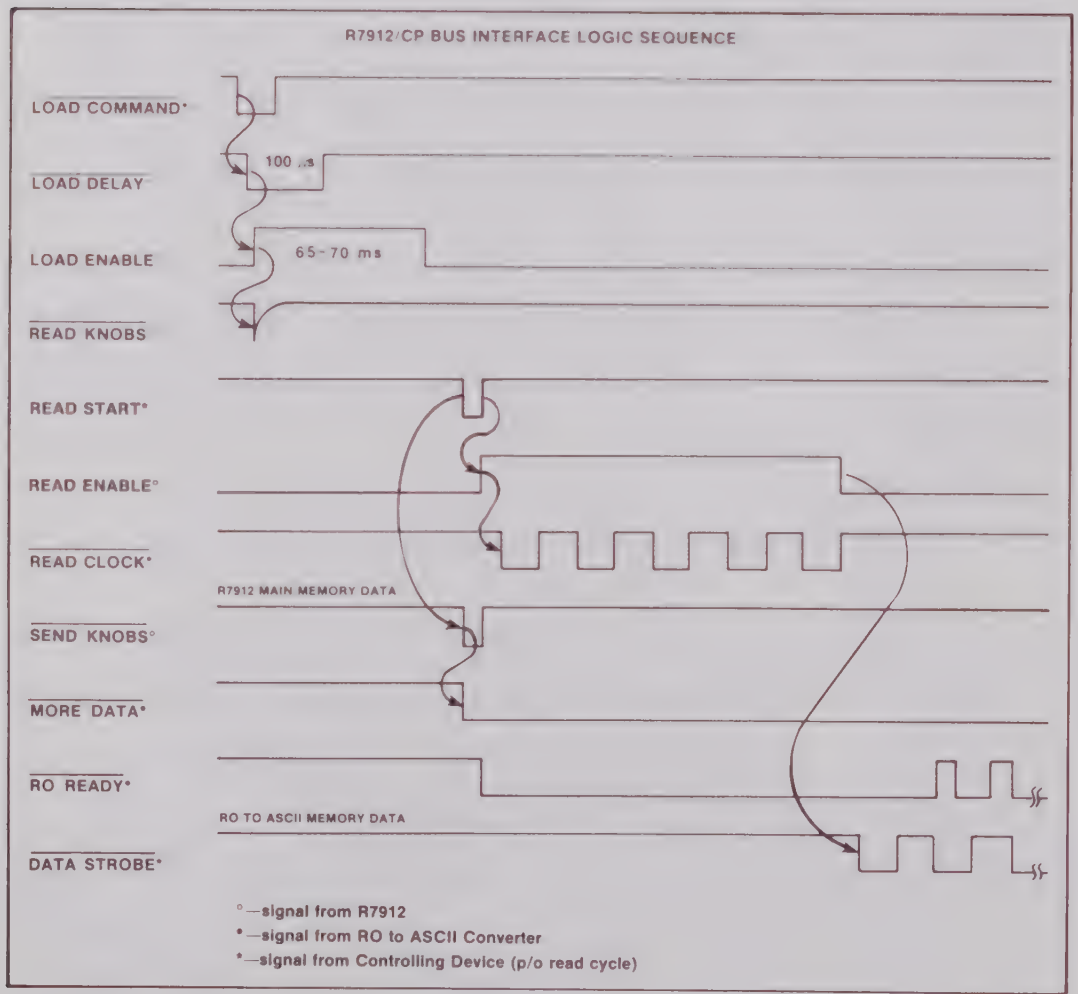


Fig. 3-39. Timing using the R7912/CP Bus Interface.

Generating The Readout

Readout Encoding Resistors

Most 7000 series plug-ins contain a network of readout encoding resistors that are switch connected to the plug-in front panel controls. Each control position selects a different combination of resistors in the network. Pulses of a precise -15V amplitude (time-slot pulses) are applied to these encoding resistors, and the resultant currents through them indicate the switch position. The currents select a row and column address in the Character Selection Matrix (Fig. 3-40). The Readout (RO) to ASCII Converter generates a digitally encoded representation of the selected character that conforms to ASCII format (see Table 3-3).

For example, in Fig. 3-41, resistors R10 through R90 control the row analog current returned to the RO to ASCII Converter. Figure 3-42 shows an idealized output current waveform of row analog data resulting from the time-slot pulses. Each of the levels of row current shown in these waveforms corresponds to 0.1 milliamp. The row numbers on the left-hand side of the waveform correspond to the rows in the Character Selection Matrix.

The column analog data is defined by resistors R110 through R190. These program resistors are connected to the time-slot lines by switch closures to encode the desired

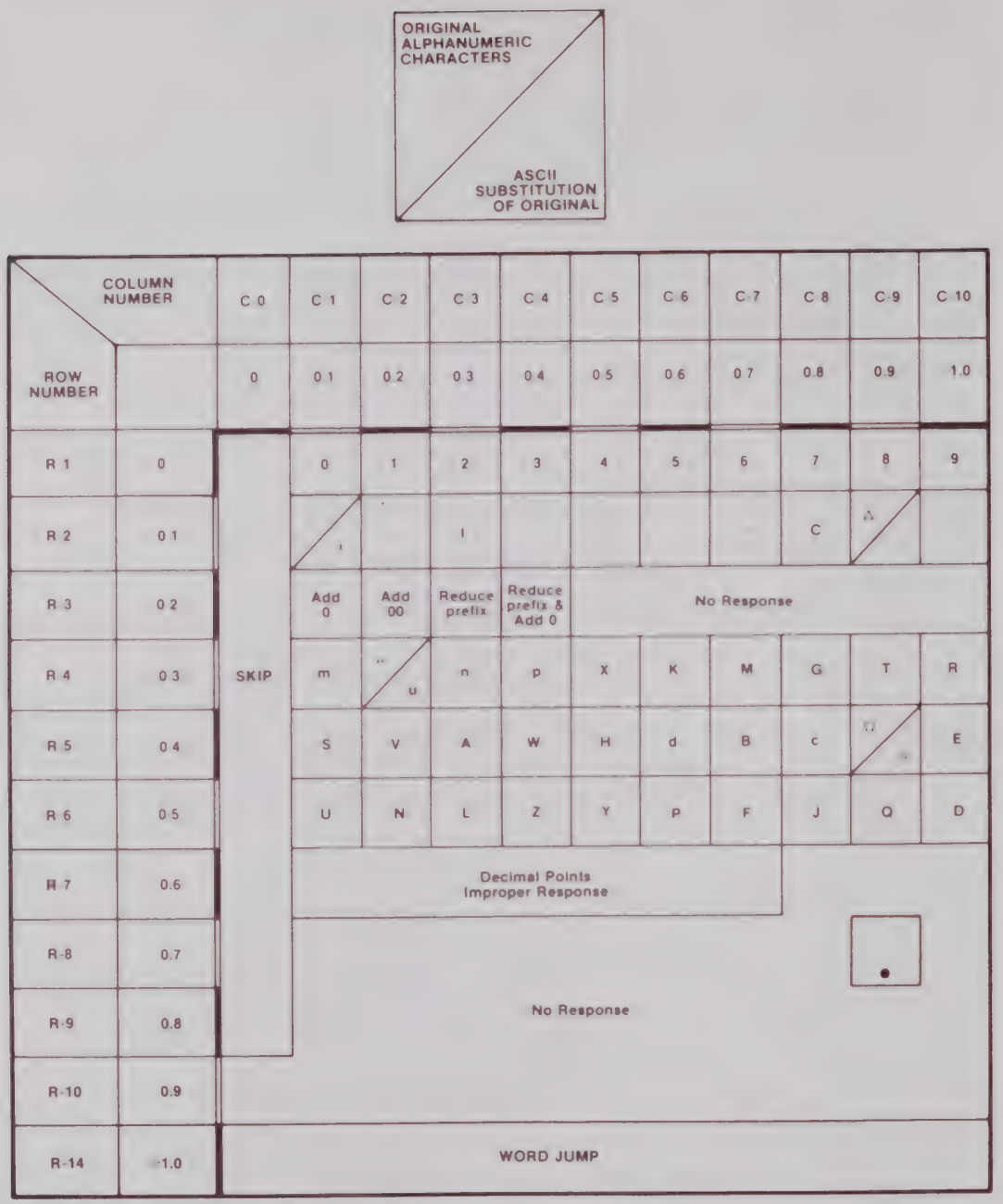


Fig. 3-40. ASCII character selection matrix.

data. Figure 3-42b shows idealized column current waveforms resulting from the time-slot pulses.

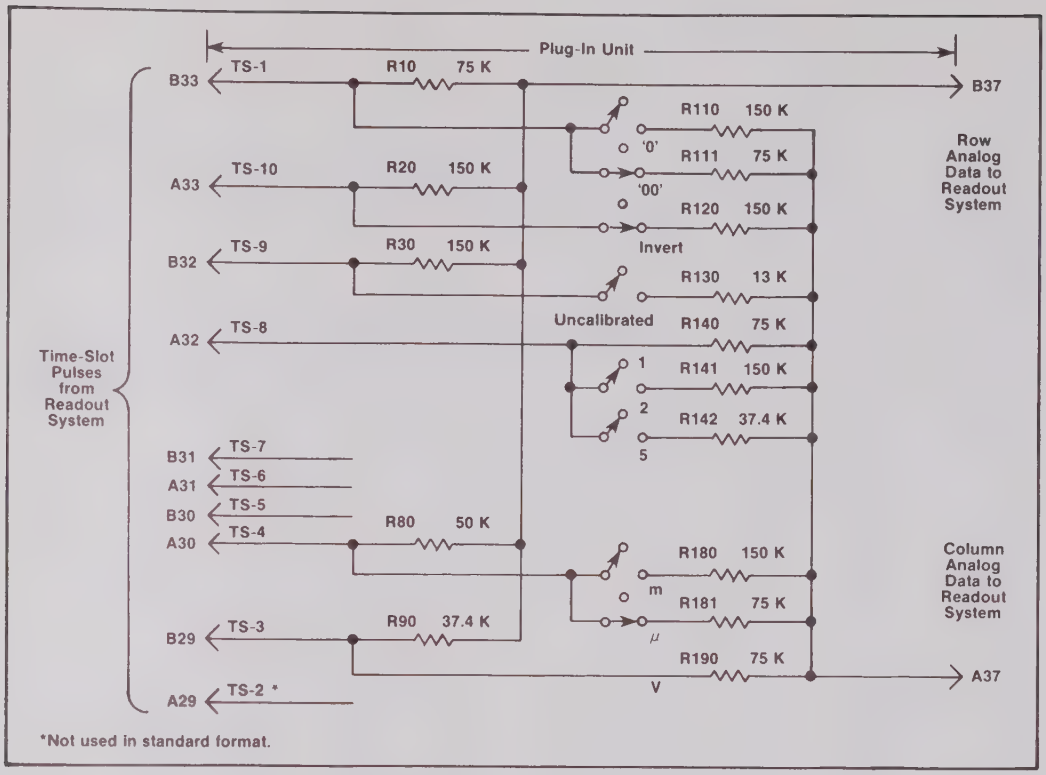


Fig. 3-41. A typical readout encoding scheme.

The -15V time-slot pulses are applied sequentially to each resistor set, and the resulting analog currents are returned to the RO to ASCII Converter. The data encoded by the circuit shown in Fig. 3-41 indicates a vertical sensitivity of 100 microvolts/division, with an inverted display and calibrated deflection factors.

TABLE 3-3

4010
USASCII CODE FUNCTIONS

BITS B_7 B_6 B_5 / B_4 B_3 B_2 B_1	ø ø ø	ø ø 1	ø 1 ø	ø 1 1	1 ø ø	1 ø 1	1 1 ø	1 1 1
	CONTROL		HIGH ORDER X & Y		LOW ORDER X		LOW ORDER Y	
ø ø ø ø	NUL ø	DLE 16	SP 32	ø 48	@ 64	P 8ø	` 96	p 112
ø ø ø 1	SOH 1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113
ø ø 1 ø	STX 2	DC2 18	" 34	2 5ø	B 66	R 82	b 98	r 114
ø ø 1 1	ETX 3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115
ø 1 ø ø	EOT 4	DC4 2ø	$ 36	4 52	D 68	T 84	d 1øø	t 116
ø 1 ø 1	ENQ 5 STATUS *	NAK 21	% 37	5 53	E 69	U 85	e 1ø1	u 117
ø 1 1 ø	ACK 6	SYN 22	& 38	6 54	F 7ø	V 86	f 1ø2	v 118
ø 1 1 1	BEL 7 BELL	ETB 23 * HARD COPY	' 39	7 55	G 71	W 87	g 1ø3	w 119
1 ø ø ø	BS 8 BACK SPACE	CAN 24	(4ø	8 56	H 72	X 88	h 1ø4	x 12ø
1 ø ø 1	HT 9 SPACE	EM 25	) 41	9 57	I 73	Y 89	i 1ø5	y 121
1 ø 1 ø	LF 1ø LINE FEED	SUB 26 GRAPH IN *	* 42	: 58	J 74	Z 9ø	j 1ø6	z 122
1 ø 1 1	VT 11 REVERSE LINE FEED	ESC 27	+ 43	; 59	K 75	[91	k 1ø7	{ 123
1 1 ø ø	FF 12 NEW PAGE *	FS 28	, 44	< 6ø	L 76	\ 92	l 1ø8	| 124
1 1 ø 1	CR 13 RETURN	GS 29 VECTOR	- 45	= 61	M 77	] 93	m 1ø9	125 ALT MODE
1 1 1 ø	SO 14	RS 3ø	. 46	> 62	N 78	^ 94	n 11ø	~ 126
1 1 1 1	SI 15	US 31 ALPHA	/ 47	? 63	O 79	_ 95	o 111	RUB OUT 127
			GRAPHIC INPUT				PRINT IN UPPER CASE	

* CHAR IS PRECEDED BY ESC CHAR TO PERFORM FUNCTION

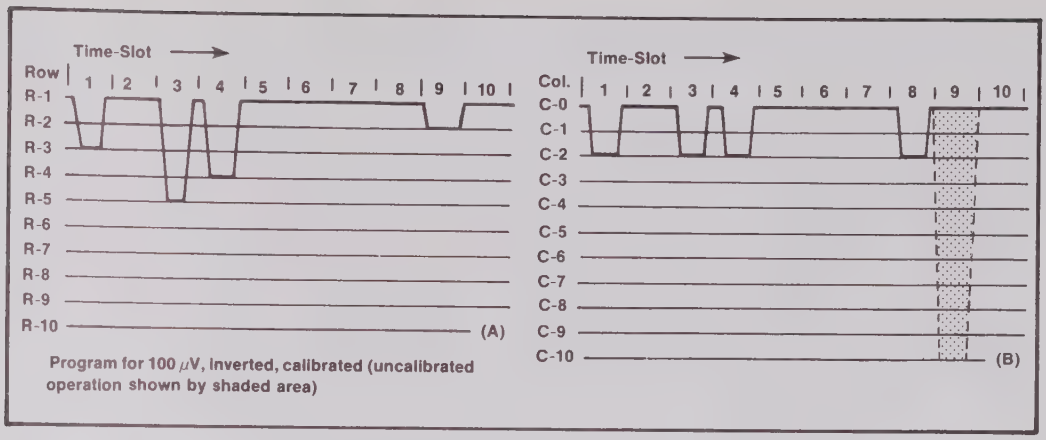


Fig. 3-42. Idealized current waveforms.

Interrogation Sequence

Time-slot 1 interrogates resistor R111 in the column return line, and R10 in the row return line. R111 encodes 0.2 milliamps of current (15V/75K = 0.2 milliamps), and R10 also encodes 0.2 milliamps of current. Referring to Fig. 3-40, 0.2 milliamps of row current and 0.2 milliamps of column current addresses "Add two zeroes" in the Character Selection Matrix.

Information encoded during time-slot 1 is not converted immediately by the RO to ASCII Converter. Instead, the matrix information is stored in the Zeros Logic and Memory stage, and re-inserted in the data field during time-slots 4, 6, and 7. The "Add two zeroes" instruction will be carried out during those time-slots. Time-slot 2 is not used to encode information in most 7000 series plug-ins.

Time-slot 3 interrogates R90 and R190 to encode UNITs data. R90 returns 0.4 milliamps of row current (15V/37.4K = 0.4 milliamps) and R190 returns 0.2 milliamps of column current. These row and column currents address the symbol "V" in the Character Selection Matrix. Decoded and converted to ASCII format, the letter V is stored in the RO to ASCII Converter memory.

Time-slot 4 interrogates R80 and R181 to encode prefix data. R80 returns 0.3 milliamps of row current, and R180 returns 0.2 milliamps of column current. These row and column currents address the symbol "u" (micro-) in the Character Selection Matrix. As described, this character is converted to ASCII format and stored in memory.

No information is encoded during time-slots 5, 6, or 7.

Time-slot 8 interrogates R140 only. No row current is generated, and the Character Selection Matrix indicates a scale factor of 1. Again, this information is converted to ASCII format and stored.

Time-slot 9 interrogates R30 only. In this case, 0.1 milliamps of row current is returned, but no column current. This combination addresses SKIP in the Character Selection Matrix. SKIP is an operational address, and causes the RO to ASCII Converter to skip one character in the data field. Data encoded during time-slot 9 indicates whether or

not the plug-in is operating in a calibrated mode. For purposes of the example, the calibrated mode is indicated. No character is generated for calibrated mode, so SKIP is addressed. SKIPs in the data field are stored in memory as ASCII spaces. Storage of spaces occurs after all other data for each channel has been stored, so that data appears right-justified during readout.

Time-slot 10 interrogates R20 and R120 in the example. Data encoded during time-slot 10 indicates whether or not the plug-in is inverting the input. The Row and Column currents address "!" in the Character Selection Matrix. This symbol indicates the inverting mode. If the input were not inverted, SKIP would again be addressed, and an ASCII SPACE would be stored. Again, space storage takes place after all other data has been stored.

Each channel (up to four) is interrogated by ten time-slot pulses as just described. All four channels are stored in the RO to ASCII Converter memory until a $\overline{\text{SEND KNOBS}}$ request is received, or until another $\overline{\text{READ KNOBS}}$ command is received. A summary of the functions of each time-slot is given in Table 3-4.

TABLE 3-4

Time Slot Functions

Time Slot Number	Description
TS 1	Determines decimal magnitude (number of zeros required, or prefix shifting data).
TS 2	No connection in normal 7000-Series plug-in units. SKIP is addressed.
TS 3	Defines the units of measurement of the plug-in unit. (V, S, etc.)
TS 4	Defines the prefix which modifies the unit of measurement.
TS 5 TS 6 TS 7	No connection in normal 7000-Series plug-ins units. Left blank to allow insertion of zeros by the readout system.
TS 8	Defines scale factor (1, 2, 5, etc.)
TS 9	Indicates calibrated or uncalibrated conditions of plug-in variable control. No data indicates calibrated operation.
TS 10	Indicates normal or inverted input to the plug-in. No data indicates normal input.

Channel Sequence

The four channels available (two vertical and two horizontal when normal plug-ins are used) are interrogated in the following sequence:

1) Channel 1 Vertical
2) Channel 2 Vertical
3) Main sweep (Delaying)
4) Delayed sweep

Circuit Description

Overview -- READ KNOBS Cycle

Block Diabram. Figure 3-43 is a simplified block diagram of the Readout to ASCII Converter. In the circuit description to follow, each major operational phase begins with a general block-diagram description. Following this general description is a detailed discussion of circuit operation.

Time-Slot 1. Knob data acquisition begins when a $\overline{\text{READ KNOBS}}$ command is received. $\overline{\text{READ KNOBS}}$ resets all counters and initiates a READ KNOBS cycle. The $\overline{\text{READING}}$ Flip-Flop is set, and the Timer begins. Timing signals are applied to the Time-Slot Counter, and time-slot pulses are generated. As previously discussed, time-slot 1 interrogates the plug-in and determines the number of zeros in the display. The analog currents are returned to the Row and Column Decoders via the Row and Column Data Switches. Selected outputs of the Row and Column Decoders are applied to Zeros Logic and

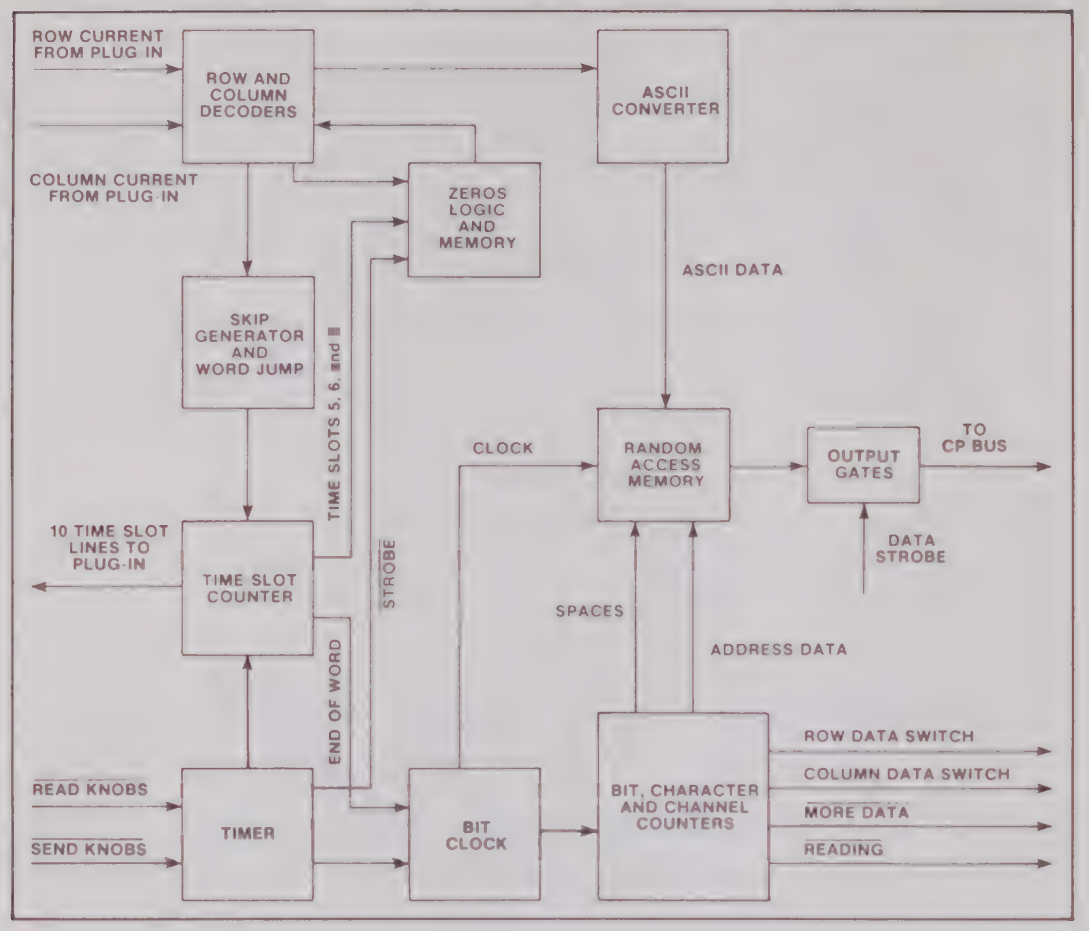


Fig. 3-43. Readout to ASCII Converter block diagram.

Memory, and the zeros information is stored. The Skip Generator circuit senses that data should not be encoded during time-slot 1 and disables the $\overline{\text{STROBE}}$ output of the Timer.

Time-slot 2 is open circuited in the plug-in, so no data is encoded. During time-slot 3, the analog row and column currents are decoded by the Row and Column Decoders and applied to the RO to ASCII ROM (Read Only Memory) via a pair of encoders. The outputs of the ROM are applied to a

Parallel-to-Serial Converter.

Bit Clock + Bit Counter. The $\overline{\text{STROBE}}$ output of the Timer enables the Bit Clock stage. This pair of one-shots generates a square wave with a period of approximately 2 microseconds. The positive-going clock output is applied to the Parallel-to-Serial Converter to clock data into the RAM (Random-Access Memory). The falling edge of the same output is applied to the Bit Counter stage, which increments the RAM address and, after counting seven ASCII bits, increments the Character Counter stage.

Character Counter. The Character Counter also increments the RAM address. When it has counted eight characters (the data field from one channel), it resets the Zeros Logic and Memory stage and increments the Channel Counter. If all eight characters in the field are not encoded, the Character Counter and the Bit Counter work together to generate an ASCII SPACE code, which is loaded into the RAM for each blank character position.

Channel Counter. The Channel Counter counts to four (two channels of data from each of the two plug-ins) while incrementing the RAM address. At the end of its count, the RAM is fully loaded with four eight-character words, each character consisting of 7 ASCII bits. The falling edge of the fourth channel count clocks the READING Flip-Flop, releasing $\overline{\text{READING}}$. The RO to ASCII Converter has read and stored all knob data from the R7912. It now awaits a $\overline{\text{SEND}}$

$\overline{\text{KNOBS}}$ command.

Circuit Operation During Read Knobs Cycle

$\overline{\text{READ KNOBS}}$. The Read Knobs Cycle begins when a 100-500 nanosecond negative $\overline{\text{READ KNOBS}}$ pulse is applied to pin 2 of P4460. The pulse resets the Bit Counter (U4481) through U4478D, and resets the Character Counter (U4485) through U4478A, U4467A, and U4478C. The Channel Counter (U4488 A and B) is cleared, and the READ Flip-Flop (U4489B) is set. The 0 output of U4489B sets $\overline{\text{READING}}$ low, enables U4467C, and starts the Timer (U4433) through U4483.

Timer. The Timer generates STROBE signals at pin 14, Trigger signals at pin 5, and precise -15-volt time-slot pulses at pin 10 (see Fig. 3-44). The Trigger output increments the Time-Slot Counter (U4445), which delivers the time-slot pulses at pin 8 to one of ten output lines (see Fig. 3-45). The output lines are energized sequentially, and time-slot pulses interrogate the network of encoding resistors in each plug-in. The resulting analog currents are returned to the circuit through the Row and Column Data Switches, U3362 and U3372.

Time-Slot 1. Time-slot 1 is a special case in the operation of the RO to ASCII Converter. During this time-slot, the plug-in is interrogated to determine if zeros and/or prefix shifting is required in the data field for that channel. This information is decoded by the Row and Column De-

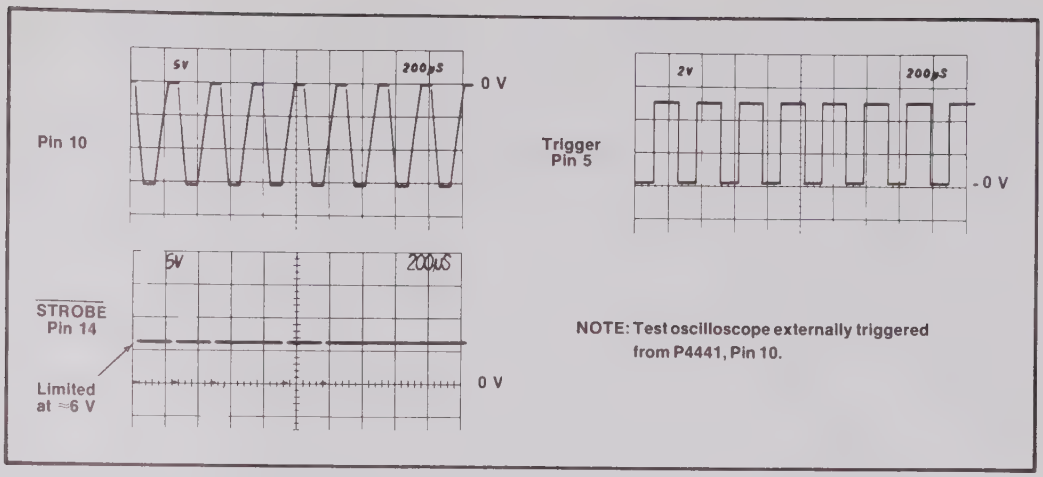


Fig. 3-44. Normal timer output waveforms.

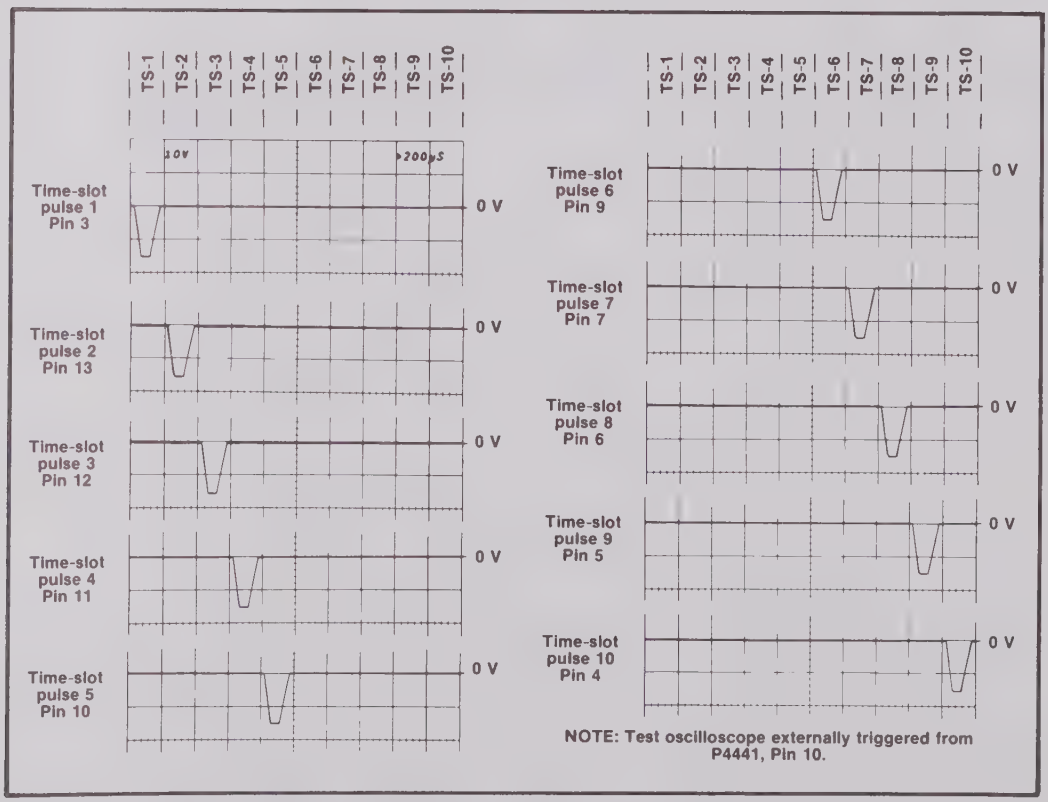


Fig. 3-45. Time-slot pulses.

coders, U4429 and U4418. Row line R3, and Column lines C1,

C2, C3, C4, and C 10 deliver the selected zeros and prefix shifting information to Zeros Logic and Memory (U4401). Pin 3 of the Time-Slot Counter informs Zeros Logic and Memory via R4402 that valid data is at its inputs and storage of zeros and prefix shifting data takes place. The Zeros Logic and Memory stage will re-insert this stored data during time-slots 4, 6, and 7.

No data is loaded into the RAM during time-slot 1. The design of the Time-Slot Counter (U4445) causes the COUNT OUT output (pin 2) to go low during time-slot 1 and at the end of each count cycle (end of each character string). COUNT OUT is low when the Readout to ASCII Converter is in a quiescent state; that is, prior to a $\overline{\text{READ KNOBS}}$ command. Since this signal remains low until time slot 1 is complete, the edge-sensitive flip-flops in U4481 and U4485 do not toggle. In this way, data handling is confined to storing information in Zeros Logic and Memory.

Time-Slot 2. Since there is normally no connection for time-slot 2 pulses in the plug-ins, no row or column current is returned. Whenever a time-slot occurs without a return of current to the Column Decoder, the SKIP GENERATOR is enabled.

Skip Generator. The Skip Generator consists of Q4406, Q4411, Q4414, And Q4416. Lack of data on the column return line biases Q4406B ON and its collector goes low. Q4416 turns on, and delivers a high SKIP signal to the SKIP INPUT

of the Timer (U4433). The SKIP signal disables the $\overline{\text{STROBE}}$ output of the Timer and, through Q4442 and U4482D, prevents the Bit Clock from starting (see Fig. 3-46). The Skip Generator is enabled whenever a blank time-slot occurs in the data field. At End-Of-Word, the Character Counter and the Bit Counter generate ASCII SPACES until the entire 8-character string is filled (see Space Generation). Therefore, when data is read from the RAM (U4469), it appears right-justified, with unused characters read as spaces.

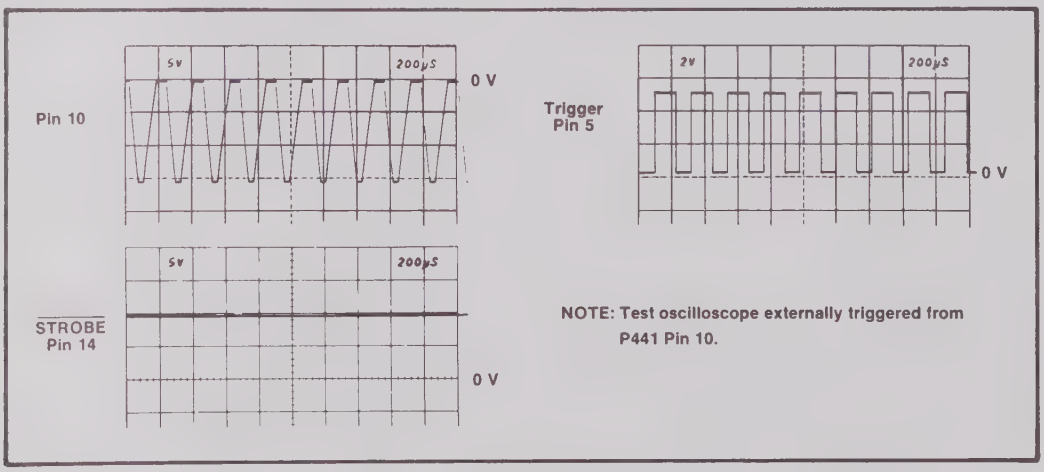


Fig. 3-46. Timer output during Display-Skip.

Time-Slot 3. Time-slot 3 interrogates UNITS data in the plug-in. The relatively long (100 microseconds) time-slot pulse allows decoding and settling of the returned analog data, so that the Parallel-to-Serial Converter (U4461) has valid data at its inputs.

$\overline{\text{STROBE}}$ (pin 14 of Timer) goes low at the beginning of the time-slot pulse and turns Q4442 ON. Q4442 causes pin 13 of U4482D to go high. Since COUNT OUT (pin 2 of Time-Slot Counter) is high, a low is applied to the SHIFT/$\overline{\text{LOAD}}$ input (pin 1) of the Parallel-to-Serial Converter (U4461). U4461 goes to $\overline{\text{LOAD}}$ mode, and the ASCII encoded data is loaded.

During time-slot 3, $\overline{\text{STROBE}}$ (pin 14 of Timer) rises, disabling U4482D and removing the high at pin 14 of U4481. The output of U4482D returns the Parallel-to-Serial Converter to the SHIFT mode. The falling edge at pin 14 clocks pin 12 of U4481 high. The high at pin 12 of U4481 enables U4480B and its output goes low. The low is returned to U4483C, part of a bistable flip-flop at the $\overline{\text{TIMER RUN}}$ input of the Timer. U4483 waits until the end of time-slot 3 (when FAST TRIG OUT, pin 5, begins to go low), then disables the Timer with U4483A and B.

Bit Clock. The high from pin 12 of U4481 is inverted and applied to the Bit Clock stage via U4480B and C. The Bit Clock stage consists of a pair of monostable multivibrators connected to produce a square wave with a period of approximately 2 microseconds. The Bit Clock is started by the low at U4480C, and begins producing clock signals at pins 9 and 10 of U4476B.

Bit Counter. The positive going output of the Bit Clock is applied simultaneously to the clock input (pin 2) of the Parallel-to-Serial Converter (U4461) and to the "B" clock input of the Bit Counter (U4481). Since each ASCII character consists of seven bits, this counter insures that seven bits are transferred from the Parallel-to-Serial Converter (U4461) to the RAM (U4469). At each count, the outputs of the Bit Counter change the address of the RAM. At count number seven, U4465A is enabled and a clock pulse is delivered to the Character Counter. The Bit Counter clears itself at the same time via U4478D. The clear signal is applied to all portions of U4481, removing the high at pin 12 and stopping the Bit Clock.

Timer Restart. When the Bit Counter clears itself and stops the Bit Clock, pin 10 of U4480C goes low. This signal is applied to a bistable flip-flop (U4483) and it restarts the Timer (U4433).

Time-Slot 4. Character Counter. As previously discussed, the $\overline{\text{STROBE}}$ output of the Timer starts the Bit Clock at the end of the time-slot pulse. The Bit Counter counts seven ASCII bits clocked into the RAM and then the Character Counter. The outputs of the Character Counter change the RAM address via U4486B, C, and D. Data from each channel consists of eight seven-bit characters. The Character Counter (U4485) counts eight characters and then resets itself with the falling edge of its pin 11 output.

Channel Counter. The falling edge of pin 22 (U4485) also increments the Channel Counter. The Channel Counter consists of two J-K flip-flops interconnected to form a divide-by-four counter. (There are four channels of data available in the R7912 -- two for each of the plug-ins.) The outputs of the Channel Counter (pins 8, 9, and 13) increment the RAM address and the Row and Column Data Switches select which channel will deliver data to the RO to ASCII Converter.

Reinsertion of Zeros and Prefix Data. The information stored in Zeros Logic and Memory is reinserted into the data field during time-slots 4, 6, and 7. These time-slot pulses are connected to Zeros Logic and Memory, and cause the stage to generate an analog current level at SHIFT OUT (pin 7). The current level corresponds to the stored data, and is applied to the Column Decoder via Q4419.

A block diagram of Zeros Logic and Memory is given in Fig. 3-47. During time-slot 4, memory A is interrogated. If prefix-shifting is required, pin 7 goes low, reducing the bias on Q4419. Q4419 effectively reduces the current at the input to the column decoder, U4418, by 0.1 milliamp. Referring to the Character Selection Matrix (Fig. 3-40) a 0.1 milliamp reduction in Column current (at row 4) addresses a higher valued prefix. Notice that a reduction of Column current from 0.1 milliamp (m- or milli-) results in a SKIP. Typical output waveforms for Zeros Logic and Memory are

given in Fig. 3-48.

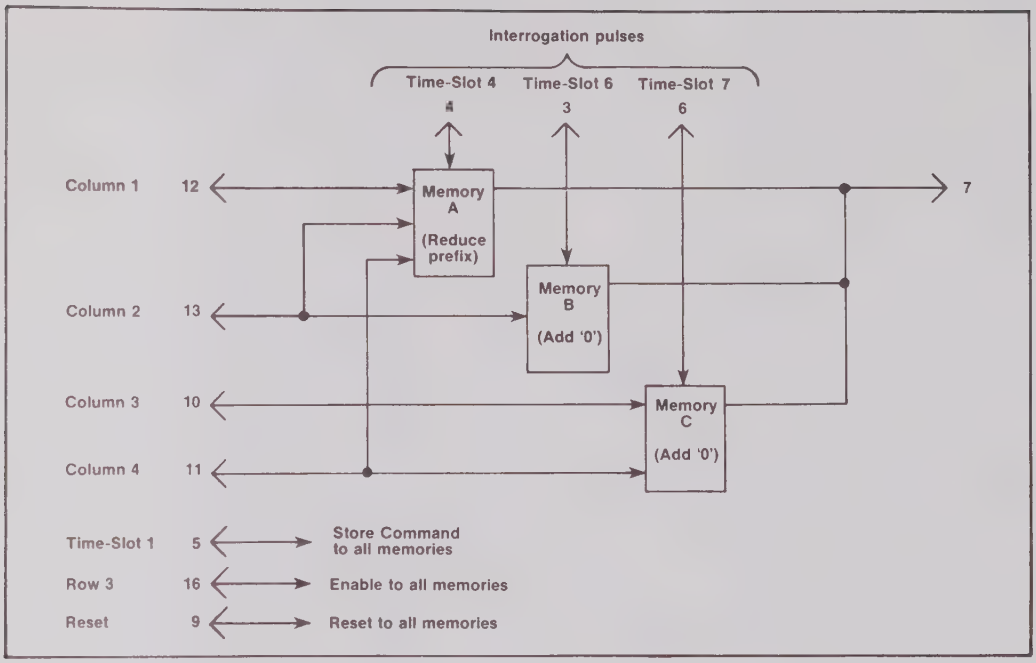


Fig. 3-47. Zeros Logic and Memory block diagram.

No encoding is provided for time-slot 5 in most 7000 series plug-ins. There is no row or column current returned, and SKIP is addressed in the Character Selection Matrix.

During time-slot 6, memory B is interrogated. If information was stored in this memory during time-slot 1, pin 7 of Zeros Logic and Memory goes high, increasing the forward bias on Q4419. Q4419 adds 0.1 milliamp of current to the input of the Column Decoder. Again referring to the Character Selection Matrix, the addition of 0.1 milliamp of current in row 3 results in a Zero added to the readout.

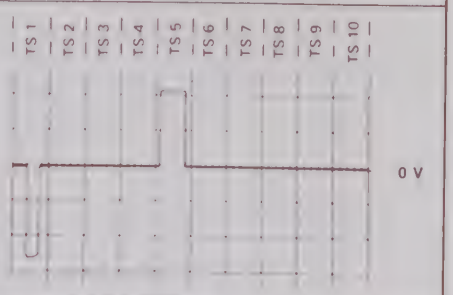
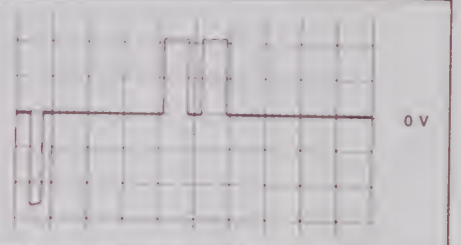
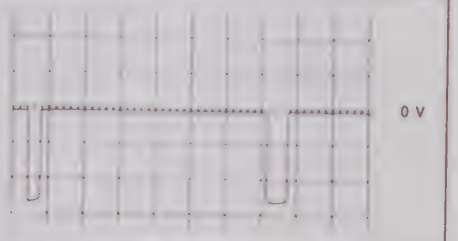
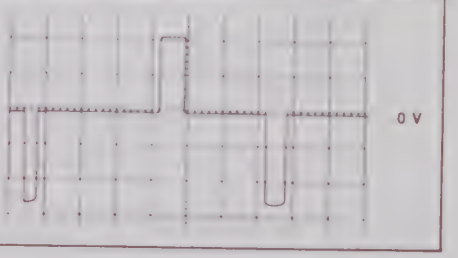
Input Pin of U4401 Addressed	Operation Selected	Time Slots
12	Add one zero	
13	Add two zeros	
10	Decrease prefix	
11	Decrease prefix and add one zero	

Fig. 3-48. Typical output waveforms.

Memory C is interrogated in time-slot 7. If another Zero is required in the readout, pin 7 will again go high, repeating the process of time-slot 6.

Time-Slot 8. Time-slot 8 interrogates the plug-in for scale factor information. Most 7000-series plug-ins use a 1, 2, 5 sequence for scale factors, and the selected value will be addressed in the Character Selection Matrix. The Readout to ASCII Converter will decode and store the data.

Time-Slots 9 and 10. As discussed previously, time-slots 9 and 10 interrogate the plug-ins for calibrated operation and inverted display data. At the end of time-slot 10, the Time Slot Counter (U4445) generates an END OF WORD pulse. This negative pulse is applied through U4480D and A to the Character Counter (top 1/4 of U4485).

Space Generation. Whenever an empty time-slot occurs, the Skip Generator is enabled. The Skip Generator prevents the Bit, Character, and Channel Counters from operating during the empty time-slot. As a result, when END OF WORD (from pin 2 of Time Slot Counter) occurs, there may only have been three or four characters loaded into the RAM (for example, a "1 mV" readout). The counters operate only during full time-slots, so only three or four counts will have registered. In order to complete the count cycle of four eight-character words and to complete the READ KNOBS cycle, ASCII spaces are generated to complete the data field.

The spaces are generated by the Bit Counter (U4481), and the Character Counter (U4485). When the END OF WORD pulse is received by the top 1/4 of U4485, pin 12 goes high. This signal is applied to U4463C and D at the DATA INPUT of the RAM (U4469).

This disables U4463A and prevents data from reaching the RAM from the Parallel-to-Serial Converter (U4461). U4463C is enabled, and allows data from the Bit Counter to enter the RAM. The output of pin 12 of U4481 is also applied to U4480B. This signal starts the Bit Clock (U4476A, B), and its "1" output begins sequencing the Bit Counter. Notice that the counter sequences on the falling edge of the clock pulse (see Fig. 3-49). Count 0 occurs during clock-pulse 1. The RAM is set in WRITE mode by the pin 9 output of the Bit Clock. The count outputs of the Bit Counter are low and the data input gates to the RAM are disabled. The RAM has no data at its input, so it stores a 0.

After clock-pulse 1, the pin 9 output of the Bit Counter goes high. The high is applied to U4465C and to the address input of the RAM. Pin 9 of U4465 is high during a clock pulse, and pin 10 goes high after count 1, but pin 11 remains low. The gate is disabled, and a "0" is again stored in the RAM. Remember that the "0" output of the Bit Clock is applied to the RAM WRITE input, enabling it during each clock pulse.

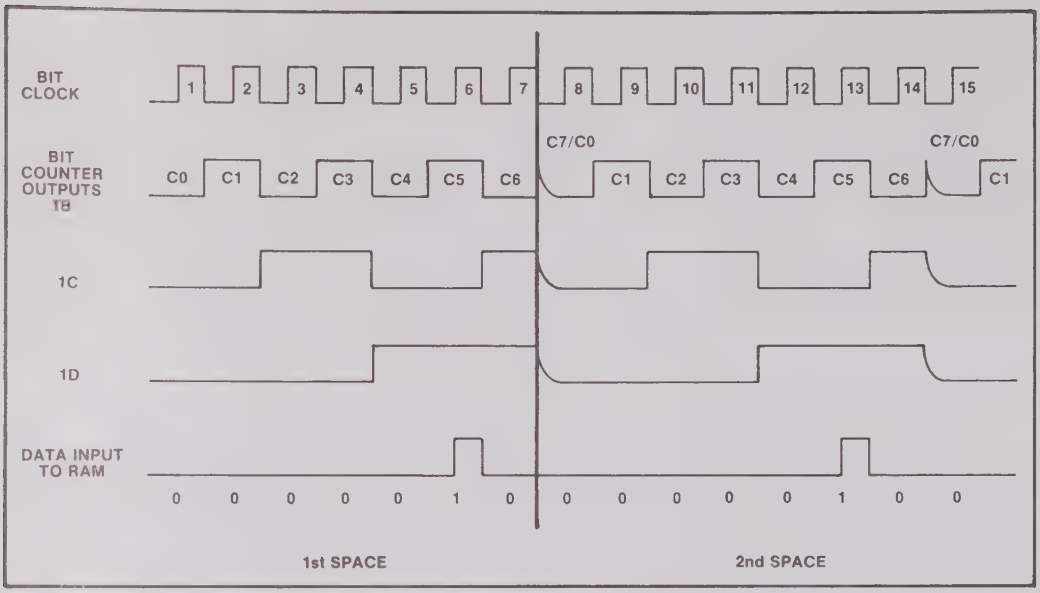


Fig. 3-49. Space generation timing.

Counts 0 through 4 cause zeros to be stored in the RAM. Count 5, which occurs after the 5th clock pulse, sets pin 11 and pin 9 of the Bit Counter (U4481) high. U4465C then has pins 10 and 11 held high, and, during clock pulse 6, pin 9 also goes high. U4465C is enabled, and a high is delivered to the RAM through U4467D.

The end of clock-pulse 6 sequences the Bit Counter to count 6. The high on pin 8 of the Bit Counter (U4481) disables U4467D and prevents data from entering the RAM. As previously discussed, a 0 is stored. The falling edge of clock pulse 7 resets the Bit Counter to zero and increments

the Character Counter (U4485).

In review, counts 0 through 4 each entered a "0" into the RAM. Count 5 entered a "1", and count 6 entered a "0". Thus, the ASCII code for SPACE (0100000) was stored. The space generation process is repeated until the entire data field of four eight-character words is filled.

End of READ Cycle. When all data, including the spaces required, is stored in memory, the Channel Counter is clocked by the falling edge of the pin 11 output of the Character Counter. Pin 9 of U4488B goes low, and clocks U4489B, releasing $\overline{\text{READING}}$. The release of $\overline{\text{READING}}$ indicates that knob data acquisition is complete.

$\overline{\text{JUMP}}$ Command. If readout from one or more channels is not desired, the $\overline{\text{JUMP}}$ command can be employed. Referring to the Character Selection Matrix, Row 14 (1.4 milliamps of row current) addresses the $\overline{\text{JUMP}}$ command. Row 14 can be addressed during time-slot 1 only.

The Row 14 detector, Q4427, is normally biased ON by R4420, 22, 23, and 25. When 1.4 milliamps of Row current is returned, the base of Q4427 goes low and turns the transistor OFF. The collector goes high and enables U4480D. The resulting low at pin 13 of U4480D is inverted by U4480A and applied to pin 14 of the Character Counter (U4485). The falling edge of the $\overline{\text{JUMP}}$ command signal clocks a high to pin 12 of the Character Counter. The high applied to U4473C

resets the Time-Slot Counter and, through U4480B and C, starts the Bit Clock. The Bit Clock advances the Bit and Character Counters, generating SPACES (see Space Generation). When the unused channel is filled with eight spaces, the END OF WORD pulse from the Time-Slot Counter (U4445) stops the Bit Clock.

Interrogation Sequence. The standard Alphanumeric readout system employed in the R7912 when the optional RO to ASCII Converter is not included interrogates the plug-in encoding resistors in a different sequence than the RO to ASCII Converter. A real-time display (such as a T.V. monitor) requires the first character read to be the first character displayed. For example, a readout of "1 mV" requires that the "1", or UNITS data be interrogated first.

The RO to ASCII Converter stores the knob readout data in memory, however. For purposes of right-justification of data and software convenience, the interrogation sequence is reversed. In the example given above, "1 mV" would be read backwards, with the "V" read first. The only exception to the time-slot reversal is time-slot 1. Both the Alphanumeric readout and the RO to ASCII Converter require that Zeros and Prefix data be read first.

The time-slot reversal becomes important when comparing the RO to ASCII Converter schematic diagram to the schematic diagram of a compatible plug-in unit. The plug-in schematic will label the time-slot lines in reverse, i.e.,

time-slot 2 from the RO to ASCII Converter will be connected to the time-slot 10 line in the plug-in. Table 3-5 details the time-slot correspondence.

TABLE 3-5

Time-Slot Correspondence

RO TO ASCII CONVERTER	TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	TS9	TS10
PLUG-IN SCHEMATIC	TS1	TS10	TS9	TS8	TS7	TS6	TS5	TS4	TS3	TS2

Overview -- SEND KNOBS Cycle

SEND KNOBS. The SEND KNOBS command resets all counters and sets the WRITE Flip-Flop. The Bit Clock is energized, and the clock pulse applied to U4467C at the READ input of the RAM and to the Serial-to-Parallel Converter. Address stepping of the RAM is accomplished by the Bit Counter, as before. When the Bit Counter has counted seven bits (one ASCII character), it resets itself and enables RO READY. RO READY is a flag indicating the presence of valid data at the output gates of the RO to ASCII Converter. The Converter now waits for DATA STROBE. When DATA STROBE is received, the output gates are enabled, and data is placed on the bus. The trailing edge of DATA STROBE restarts the Bit Clock, and the RAM begins clocking the next character into the Serial-to-Parallel Converter. This process is repeated 32 times (4 channels of 8 characters - 32 characters).

Again, RAM address stepping is performed by the Bit, Character, and Channel counters. When all data has been read out, MORE DATA is released.

Circuit Operation During Send Knobs Cycle

SEND KNOBS. The RO to ASCII Converter requires a SEND KNOBS command to initiate data transfer from memory to the CP Bus (see Fig. 3-39). SEND KNOBS, a negative going ≈ 150 nanosecond pulse, clears the Character and Channel Counters and sets the WRITE Flip-Flop, U4489A. The pin 14 output of U4489A goes low and issues MORE DATA. MORE DATA remains low until all data has been read from the RO to ASCII Converter (or until another READ KNOBS command is received).

The high on pin 15 of U4489A enables the Serial-to=Parallel Converter, U4471, and the READY gate, U4482B. (READOUT READY is not issued, since pin 4 is still low.) It also disables U4467B, preventing Bit Counter U4481 from clocking Character Counter U4485.

Bit Clock. SEND KNOBS clocks the top 1/4 of U4481 through U4465B. The high that results on pin 12 of U4481 is applied through U4480B and C to start the Bit Clock. The clock pulses are applied to U4467C at the Mode input of U4469, which is now in the READ mode (U4489B released at the end of the Read Knobs cycle), and to the Serial-to-Parallel Converter. The Bit Clock increments the RAM address at the end of each clock pulse, and seven bits of

data are clocked out of the RAM and into the Serial-to-Parallel Converter. Pin 12 of U4481 goes low, and stops the Bit Clock through U4480B and C. The high at pin 4 of U4480B is applied to pin 4 of U4482B, and $\overline{\text{RO READY}}$ is issued.

$\underline{\overline{\text{DATA STROBE}}}$. When the $\overline{\text{RO READY}}$ flag is sensed, the controlling device sends $\overline{\text{DATA STROBE}}$, a negative-going pulse (pulse width is dependent upon the user's system). The data output drivers (U4473 and U4474) are enabled, and the data at the outputs of U4471 is placed on the CP Bus. $\overline{\text{DATA STROBE}}$ is also applied to the top 1/4 of the Bit Counter, U4481. At the rising edge of the $\overline{\text{DATA STROBE}}$ pulse, pin 12 of U4481 goes high and restarts the Bit Clock. The Character Counter is incremented at the same time via U4482C and U4486A. Since the output of U4480B is low, U4482B is disabled, and $\overline{\text{RO READY}}$ is released.

RAM Address Inversion. The Character Counter increments the RAM address through U4486B, C, and D. Notice that pins 4, 10, and 13 are connected to pin 11 of the READING Flip-Flop, U4489B. During a READ KNOBS cycle, pin 11 is high; during a SEND KNOBS cycle, low. Examination of the truth table of an exclusive OR gate reveals that if one input is held high, the other input will appear inverted at the output. If one input is held low, however, no inversion occurs. This characteristic allows the RAM address to be incremented in reverse order as characters are read out. Characters then appear in the proper sequence when placed on

the CP Bus.

When the Bit Clock has clocked seven more bits from the RAM into the Serial-to-Parallel Converter, the Bit Counter clears itself, stops the Bit Clock, and asserts $\overline{\text{RO READY}}$. The controlling device senses the $\overline{\text{RO READY}}$ flag, and issues $\overline{\text{DATA STROBE}}$.

As previously discussed, the output gates (U4473 and U4474) are enabled. The rising edge of $\overline{\text{DATA STROBE}}$ restarts the Bit Clock and begins another character transfer from the RAM to the Serial-to-Parallel Converter.

End of SEND KNOBS Cycle. The SEND KNOBS cycle is repeated 32 times (four eight-character words -- 32 cycles). At the end of the 32nd cycle, pin 9 of the Channel Counter (U4488B) goes low and clocks the WRITE Flip-Flop (U4489A), releasing $\overline{\text{MORE DATA}}$. The release of $\overline{\text{MORE DATA}}$ indicates that all data has been read from the RO to ASCII Converter. Further attempts to strobe data will result in a null data field.

SECTION 4

MAINTENANCE

This section of the manual contains information for use in preventive maintenance, troubleshooting, or corrective maintenance of the R7912.

PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, visual inspection, lubrication, etc. Preventive maintenance performed on a regular basis may prevent instrument breakdown, and will improve the reliability of this instrument. The severity of the environment to which the R7912 is subjected determines the frequency of maintenance. A convenient time to perform preventive maintenance is preceding recalibration of the instrument.

General Cleaning Instructions

The R7912 should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket and prevents efficient heat dissipation. Also, dirt provides an electrical conduction path which may result in instrument failure. The top and bottom panels provide protection against dust in the interior of the instrument. Operation without the panels in place necessitates more frequent cleaning.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Do not use chemicals which contain benzene, toluene, xylene, acetone or similar solvents. An isopropyl or denatured ethyl alcohol cleaning agent is strongly recommended, especially for etched circuit boards and cam switches. Before using other solutions, contact your local Tektronix Service Center.

Cleaning the Exterior

Loose dust accumulated on the outside of the R7912 can be removed with a soft cloth or small brush. The brush is particularly useful for dislodging dirt on and around the front-panel controls. Dirt that remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used.

Cleaning the Interior

Dust in the interior of the instrument should be removed occasionally due to its electrical conductivity under high-humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low-pressure air. Remove any dirt which remains with a soft brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces between components mounted on circuit boards.

The high-voltage circuits, particularly the area surrounding the post-deflection anode lead, should receive special attention. Excessive dirt in these areas may cause high-voltage arcing and result in improper instrument operation.

Lubrication

The reliability of potentiometers, switches, and other moving parts can be maintained if they are kept properly lubricated. However, over-lubrication is as harmful as too little lubrication. A lubrication kit containing necessary lubricants and instructions is available from Tektronix, Inc. Order Part No. 003-0342-01.

Visual Inspection

The R7912 should be inspected occasionally for such defects as broken connections, improperly seated semiconductors, damaged or improperly installed circuit boards, and heat-damaged parts. The corrective procedure for most visible defects is obvious; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument, and it is important that the cause of overheating be corrected to prevent recurrence of the damage.

Semiconductor Checks

Periodic checks of the semiconductors in the R7912 are not recommended. The best check of semiconductor performance is actual operation in the instrument. More details on checking semiconductor operation are given under troubleshooting.

Recalibration

To ensure accurate measurements, check the calibration of this instrument after each 1000 hours of operation or every six months if used infrequently. In addition, replacement of components may necessitate recalibration of the affected circuits. The calibration procedure can also be helpful in localizing certain troubles in the instrument. In some cases, minor troubles may be revealed or corrected by recalibration.

TROUBLESHOOTING

Introduction

The following information is provided to facilitate troubleshooting the R7912. Information contained in other sections of this manual should be used along with the following information to aid in locating the defective component. An understanding of the circuit operation is very helpful in locating troubles, particularly where integrated circuits are used. See the Circuit Description section for complete information.

Troubleshooting Aids

Diagrams. Complete circuit diagrams are given on foldout pages in the Diagrams section. The component number and electrical value of each component in the R7912 are shown on these diagrams. Each main circuit is assigned a distinct series of component numbers. Important voltages and waveforms are also shown on the diagrams. The portions of the circuit mounted on circuit boards are enclosed by dashed lines.

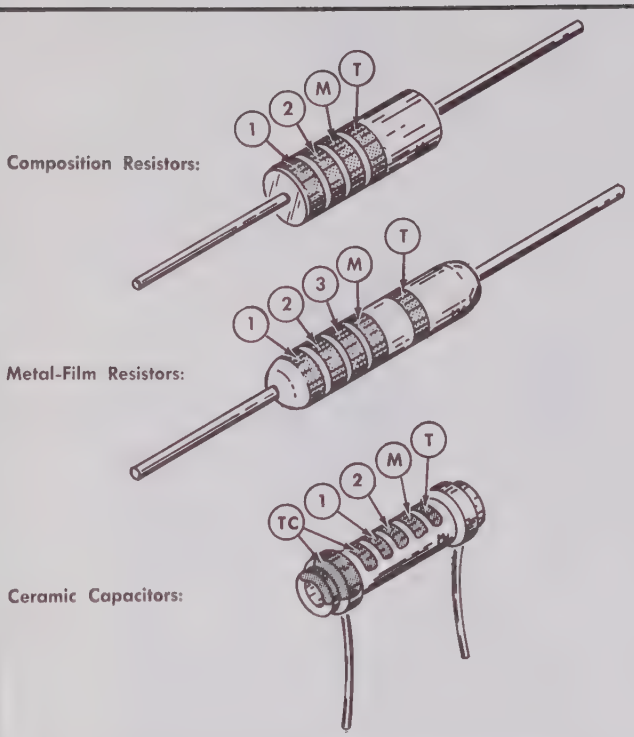
Circuit Boards. Illustrations of the circuit boards are shown in Fig. 8-1 through 8-30. These illustrations are located in the Diagrams section on the back of the page opposite the circuit diagram, to aid in cross-referencing

between the diagrams and the circuit-board components. Each electrical component on the boards is identified by its circuit number. The location of any interconnecting connectors is also shown.

Multi-Pin Connector Color Code. The multi-pin connectors used for interconnection between circuit boards are color coded to aid in circuit tracing. The color of the connector body matches the resistor color code for the last digit of the circuit number, e.g., P601 is brown, P603 is orange, etc.

Wiring Color Code. All insulated wire and cable used in the R7912 is color-coded to facilitate circuit tracing.

Resistor Color Code. In addition to the brown composition resistors, some metal-film resistors and some wire-wound resistors are used in the R7912. The resistance values of wire-wound resistors are usually printed on the body of the component. The resistance values of composition resistors and metal-film resistors are color-coded on the components with EIA color code (some metal-film resistors may have the value printed on the body). The color code is read starting with the stripe nearest the end of the resistor. Composition resistors have four stripes which consist of two significant figures, a multiplier, and a tolerance value (see Fig. 4-1). Metal-film resistors have five stripes consisting of three significant figures, a multiplier, and a tolerance value.



1 2 and 3 —1st, 2nd and 3rd significant figures;
M —multiplier; T —tolerance;
TC —temperature coefficient.

Resistor and Capacitor Color Code

Color	Significant Figures	Multiplier		Tolerance	
		Resistors	Capacitors	Resistors	Capacitors
Silver	---	10^{-2}	---	±10%	---
Gold	---	10^{-1}	---	±5%	---
Black	0	1	1	---	±20% or 2 pF*
Brown	1	10	10	±1%	±1% or 0.1 pF*
Red	2	10^{2}	10^{2}	±2%	±2%
Orange	3	10^{3}	10^{3}	±3%	±3%
Yellow	4	10^{4}	10^{4}	±4%	+100% —0%
Green	5	10^{5}	10^{5}	±0.5%	±5% or 0.5 pF*
Blue	6	10^{6}	10^{6}	---	---
Violet	7	---	---	---	---
Gray	8	---	10^{-2}	---	+80% —20% or 0.25 pF*
White	9	---	10^{-1}	---	±10% or 1 pF*
(none)	---	---	---	±20%	±10% or 1 pF*

*For capacitance of 10 pF or less.

NOTE: T and/or TC color code for capacitors depends upon manufacturer and capacitor type. May not be present in some cases.

Fig. 4-1. Color code for resistors and ceramic capacitors.

Capacitor Markings. The capacitance values of common disc capacitors and small electrolytics are marked on the side of the component body. The white ceramic capacitors used in the R7912 are color-coded in picofarads, using a modified EIA code (see Fig. 4-1).

Diode Color Code. The cathode end of each glass-encased diode is indicated by a stripe, a series of stripes, or a dot. For most silicon or germanium diodes with a series of stripes, the color code identifies the

three significant digits of the Tektronix Part Number using the resistor color code system (e.g., a diode color-coded pink- or blue -, brown - gray - green indicates Tektronix Part No. 152-0185-00). The cathode and anode ends of metal-encased diodes can be identified by the diode symbol marked on the body.

Semiconductor Lead Configuration. Figure 4-2 shows the lead configuration for the semiconductors used in this instrument, as viewed from the bottom of the semiconductors.

Troubleshooting Equipment

The following equipment is useful for troubleshooting the R7912:

Transistor Tester: Tektronix Type 576 Transistor Curve Tracer or equivalent.

Multimeter: Digital voltmeter, 10-megohm input impedance and up to 500 volts range; ohmmeter, 0 to 15 megohms. Accuracy, within 1%. Test probes must be insulated to prevent accidental shorting.

NOTE

A 20,000 ohms/volt VOM can be used to check the voltages in this instrument if allowances are made for the circuit loading of the VOM at high-impedance points.

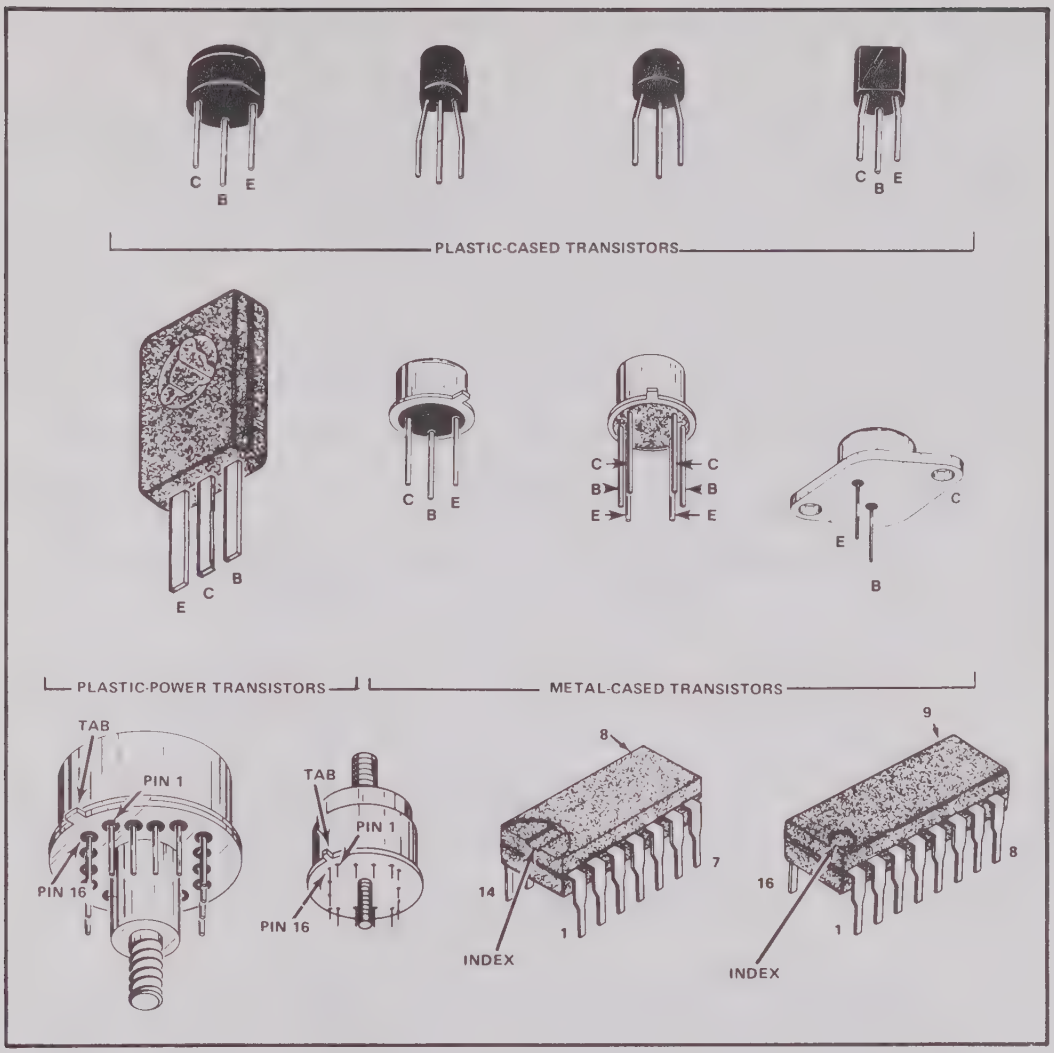


Fig. 4-2. Semiconductor lead configurations.

Test Oscilloscope: Frequency response, DC to 50 megahertz; deflection factor, 50 volts/division. A 10X probe should be used to reduce circuit loading.

Troubleshooting Techniques

This troubleshooting procedure is arranged in an order which checks the simple trouble possibilities before proceeding with extensive troubleshooting. The first few checks ensure proper connection, operation, and calibration. If the trouble is not located by these checks, the remaining steps aid in locating the defective component. When the defective component is located, it should be replaced following the replacement procedures given under Corrective Maintenance.

1. Check Control Settings. Incorrect control settings can indicate a trouble that does not exist. If there is any question about the correct function or operation of any control, see the Operating Information section.

2. Check Associated Equipment. Before proceeding with troubleshooting of the R7912, check that the equipment used with this instrument is operating correctly. Check that the signal is properly connected, and that the interconnecting cables are not defective. Also, check the power source. The associated plug-in units can be checked for proper operation by substituting other units which are known to be operating properly (preferably of the same types). If the trouble persists after substitution, the R7912 is probably at fault.

3. Visual Check. Visually check the portion of the instrument in which the trouble is located. Many troubles can be located by visual indications such as unsoldered connections, broken wires, damaged circuit boards, and damaged components.

4. Check Instrument Calibration. Check the calibration of this instrument, or the affected circuit if the trouble appears in one circuit. The apparent trouble may only be a result of misadjustment, which can be corrected by calibration. Complete calibration instructions are given in the Calibration section.

5. Isolate Trouble to a Circuit. To isolate trouble to a particular circuit, note the trouble symptom. The symptom often identifies the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check the affected circuits by taking voltage and waveform readings. Typical voltages and waveforms are given on the schematics in the Diagrams section.

Incorrect operation of all circuits often indicates trouble in the power supply. Check first for correct voltage of the individual supplies. A defective component elsewhere in the instrument can appear as a power supply problem and may also affect the operation of other circuits.

Table 4-1 lists the tolerances of the power supplies in this instrument. These voltages are measured between the power supply test points and ground. If a power supply voltage is within the listed tolerance, the supply can be assumed to be working correctly. If outside the tolerance, the supply may be misadjusted or operating incorrectly. Use the procedure given in the Calibration section to adjust the power supplies.

TABLE 4-1

Power Supply	Voltage Tolerance	Maximum Ripple (peak to peak)
-50 V	Adjustable	2 mV
-15 V	0.15 V	1 mV
+5 V	0.1 V	1 mV
+15 V	0.15 V	1 mV
+50 V	0.5 V	3 mV
+130 V	5.2 V	500 mV
Control Illum (+5 V)	+0.2 V -0.5 V	25 mV

If incorrect operation of the power supplies is suspected, connect the R7912 to a variable autotransformer. Then, check for correct regulation with a DC voltmeter (0.1% accuracy) and check ripple with a test oscilloscope while varying the autotransformer throughout the regulating range of this instrument.

After the defective circuit has been located, proceed with steps 6 and 7 to locate the defective component(s).

6. Check Voltages and Waveforms. Often the defective component can be located by checking for the correct voltage or waveform in the circuit. Typical voltages and waveforms are given on the diagrams.

NOTE

Voltages and waveforms given on the diagrams are not absolute and may vary slightly between instruments.

7. Check Individual Components. The following procedures describe methods of checking individual components in the R7912. Components which are soldered in place are best checked by first disconnecting one end. This isolates the measurement from the effects of surrounding circuitry.

A. SEMICONDUCTORS.

CAUTION

Power switch must be turned off before removing or replacing semiconductors.

A good check of transistor operation is actual performance under operating conditions. A transistor can most effectively be checked by substituting a new component (or one which has been checked previously). However, be sure

that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended, since they do not check operation under simulated operating conditions.

Integrated circuits can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of the circuit operation is essential for troubleshooting circuits using integrated circuits. Operating waveforms, logic levels, and other operating information for the integrated circuits are given in the Circuit Description section. Use care when checking voltages and waveforms around the integrated circuits so that adjacent leads are not shorted together. A convenient means of connecting a test probe to 14- and 16-pin integrated circuits is with an integrated circuit test-clip. This device also doubles as an extraction tool.

B. DIODES. A diode can be checked for an open or shorted condition by measuring the resistance between terminals. With an ohmmeter having an internal voltage source of between 800 millivolts and 3 volts, the resistance should be very high in one direction and very low when the meter leads are reversed.

CAUTION

Do not use an ohmmeter that has a high internal current. High currents may damage the diodes under test.

C. RESISTORS. Check the resistors with an ohmmeter. See the Electrical Parts List for the tolerance of the resistors used in this instrument. Resistors normally do not need to be replaced unless the measured value varies widely from the specified value.

D. INDUCTORS. Check for open inductors by checking continuity with an ohmmeter. Shorted or partially shorted inductors can usually be found by checking the waveform response when high-frequency signals are passed through the circuit. Partial shorting often reduces high-frequency response.

E. CAPACITORS. A leaky or shorted capacitor can best be detected by checking the resistance with an ohmmeter on the highest scale. Make certain no residual charge remains on the capacitor, and with the ohmmeter. Do not exceed its voltage rating. The resistance reading should be high after initial charge of the capacitor. An open capacitor can best be detected with an capacitance meter or by checking if the capacitor passes AC signals.

8. Repair and Readjust the Circuit. If any defective parts are located, follow the replacement procedures given in this section. Be sure to check the performance of any circuit that has been repaired or has had any electrical components replaced.

CORRECTIVE MAINTENANCE

Corrective maintenance consists of component replacement and instrument repair. Special techniques required to replace components in this instrument are given here.

Obtaining Replacement Parts

Standard Parts. All electrical and mechanical part replacements for the R7912 can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating, and description.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance in the instrument, particularly at high frequencies. All parts should be direct replacements unless it is known that a different component will not adversely affect instrument performance.

Special Parts. In addition to the standard electronic components, some special components are used in the R7912. These components are manufactured or selected by Tektronix, Inc. to meet specific performance requirements, or are manufactured for Tektronix, Inc. in accordance with our specifications. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. Order all special parts directly from your local Tektronix Field Office or representative.

Ordering Parts. When ordering replacement parts from Tektronix, Inc., include the following information:

1. Instrument type.

2. Instrument serial number.

3. A description of the part (if electrical, include circuit number).

4. Tektronix part number.

Soldering Techniques

WARNING

Disconnect the instrument from the power source before soldering. To prevent damage from static discharge, use only soldering irons having a grounded tip. If a grounded iron is not available, attach a ground lead to the iron tip before soldering.

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used when repairing or replacing parts. General soldering techniques that apply to maintenance of any precision electronic equipment should be used when working on this instrument. Use only 60/40 rosin-core electronic-grade solder.

The choice of soldering iron is determined by the repair to be made. When soldering on circuit boards, use a 15- to 40-watt pencil-type soldering iron with an 1/8-inch wide, wedge-shaped tip. Keep the tip properly tinned for best heat transfer to the solder joint. A higher wattage soldering iron may separate the wiring from the base material. Avoid excessive heat; apply only enough heat to remove the component or to make a good solder joint. Also, apply only enough solder to make a firm solder joint; do not apply too much solder.

For large terminals (e.g., power switch terminals, or potentiometers) a higher wattage-rating soldering iron may be required. For example, if the component is connected to the chassis or other large heat-radiating surface, a 75-watt or larger soldering iron may be required. The pencil-type soldering iron used on the circuit board can be used for soldering to smaller switch terminals, potentiometers, or metal terminals mounted in plastic holders.

After soldering is completed, clean the area around the solder connection with a flux-removing solvent. Be careful not to remove any printed information.

COMPONENT REPLACEMENT

WARNING

Disconnect the instrument from the power source before replacing components.

Opening the Front Panel

The swing-out front panel of the R7912 is held in place by two captive screws near the vertical plug-in compartment. To open the panel, remove both plug-in units. The two securing screws at the left edge of the plug-in compartment can be loosened with a small screwdriver.

When the screws are loose, open the panel about 1/2 inch; then slide it to the right (toward the plug-in compartment) about 1/4 inch. The lateral motion releases the hinge, allowing the panel to be opened completely.

CAUTION

Attempting to open the front panel without first releasing the hinge will damage the hinge structure.

Plug-in Circuit Cards

Several plug-in circuit cards are located behind the front panel. Each card has a release cam at the bottom edge. To remove a card, pull out and down on the release latch until the card slips out of the edge connector. Then slide the card out of the guides.

To replace the cards, orient them correctly (release latch down, component side to the left) and slide each one carefully into its guide. When the edge connector is reached, more pressure is required to seat the card. Make certain the card and connectors align correctly before applying pressure.

CAUTION

The cards are not interchangeable from slot to slot. They must be inserted in the correct slots only.

The exploded-view drawings that accompany the Mechanical Parts List (located at rear of this manual) may be helpful in removal or disassembly of individual components or sub-assemblies.

To gain access to the boards in the rear of the instrument, the power unit must first be removed as explained below:

Power-Unit Removal

The power unit can be slid out of the back of the R7912 for power-unit maintenance. The power unit can be operated in this position for easy troubleshooting. To remove the power unit, use the following procedure:

WARNING

Extreme caution must be used when troubleshooting in the power unit, due to the presence of line voltage and high voltage.

1. Remove the screws that secure the power unit to the rear of the instrument.

2. Slide the power unit out of the rear of the instrument until it can be set down on the work surface (guide the interconnecting cables so they do not catch on other components or parts of the instrument).

WARNING

Disconnect the instrument from the power source before removing the power-unit cover. The primary storage capacitors, C1216 and C1217, remain charged with high voltage DC for several minutes after the line power is disconnected. A warning indicator (neon bulb), located on the Power Supply Inverter board, flashes when this stored voltage exceeds about 80 volts. Do not remove the power-unit cover while this light is flashing.

Circuit Board Replacement

If a circuit board is damaged beyond repair, the entire assembly, including all soldered-on components, can be replaced. Part numbers are given in the Mechanical Parts List for the completely wired (670-XXXX-XX) board.

Most of the circuit boards in this instrument are mounted on the chassis; pin connectors are used for interconnection with other circuits. Use the following procedure to remove the chassis-mounted circuit boards (removal instructions for the exceptions are given later).

Chassis-Mounted Boards Replacement

1. Disconnect any pin connectors on the board or connected to other portions of the instrument. Note the order of these connectors so they can be correctly replaced.

2. Remove the securing screws.

3. Remove the board.

4. To replace the board, reverse the order of removal. Match the arrows on the multi-pin connectors to the arrows on the board. Correct location of the pin connectors is shown in the circuit board illustrations in the Diagrams section.

Low-Voltage Regulator Circuit Board Replacement

1. Slide the power unit out of the rear of the instrument as described previously. Remove the top cover (remove six screws on top and two screws on rear panel).

2. Disconnect the multi-pin connector from the board.

3. Remove the bolts securing the power transistors to the bottom of the heat radiator. Remove the screws securing the board to the power unit.

4. To replace the Low-Voltage Regulator board, reverse the order of removal. Apply a thin coat of silicone grease on the back (mounting surface) of each plastic transistor before securing it to the heat radiator.

Cap Rectifier Board Replacement

To replace the Cap Rectifier board, proceed as follows:

1. Slide out the power unit as described previously. Remove the top cover.

2. Remove the screws holding the top corners and bottom of the Low Voltage board heat-radiator to the power unit and slide the heat-radiator forward.

3. Disconnect the multi-pin connectors that connect the Low Voltage board to the Cap Rectifier board.

4. Remove the screws securing the Cap Rectifier board to the power unit. Unsolder the transformer leads from the board. Pull the board forward.

5. To replace the Cap Rectifier board, reverse the removal procedure.

Power Supply Inverter Board Replacement

To remove and replace the Power Supply Inverter board, use the following procedure. An exploded-view drawing of the power unit is shown in Fig. 3 at the rear of the Manual in the Mechanical section. There are several different ways to disassemble the power-unit, but to ensure safe operation follow the procedure.

WARNING

The power-unit assembly has been tested at the factory to ensure safe operation. Do not remove the plate insulator, block insulator, or transistor shield from the rear panel. Improper disassembly or assembly of this unit can result in hazardous voltages on the chassis of this instrument.

1. Disconnect the instrument from the power source.

2. Slide the power unit out as described previously, and remove the top cover. Remove the Low-Voltage assembly (Low-Voltage board and heat-radiator). See Low-Voltage Board Replacement.

3. Remove the screws securing the power transistor protective cover on the Inverter board. Unsolder the three transformer leads from the Inverter board. Remove the excess solder from the board with a vacuum-type desoldering tool.

4. Remove the Cap-Rectifier board.

5. Remove the right side panel of the power unit.

6. Unsolder the line input leads on the inverter board from the Line Selector assembly.

7. Remove the screws securing the inverter shield to the transistor heat shield.

8. Remove the four nuts securing the inverter power transistors to the inverter board and remove the transistors. Remove the four screws securing the two storage capacitors to the inverter board.

9. Slide the inverter board and inverter shield away from the transistor shield until the mounting studs clear the heat shield. Remove the Power Supply Inverter board and inverter shield as a unit.

10. To replace the Power Supply Inverter board, reverse the removal procedure.

Semiconductor Replacement

A semiconductor should not be replaced unless it is actually defective. If a semiconductor is removed from its socket during routine maintenance, return it to the original socket. Unnecessary replacement of semiconductors may affect the calibration of this instrument. When semiconductors are replaced, check the operation of any part of the

instrument that may be affected.

CAUTION

POWER switch must be turned off before removing or replacing semiconductors.

Replacement semiconductors should be of the original type or a direct replacement. Figure 4-2 shows the lead configuration of the semiconductors used in this instrument. Some plastic case transistors have lead configurations that do not agree with those shown. If a replacement transistor is made by a different manufacturer than the original, check the manufacturer's basing diagram for correct basing. All transistor sockets in the R7912 are wired for the standard basing as used for metal-cased transistors. Transistors which have heat radiators or are mounted on the chassis use silicone grease to increase heat transfer. Replace the silicone grease when replacing these transistors.

WARNING

Handle silicon grease with care. Avoid getting silicone grease in the eyes. Wash hands thoroughly after use.

An extracting tool should be used to remove the 14- and 16-pin integrated circuits to prevent damage to the pins. This tool is available from Tektronix, Inc. Order Tektronix Part No. 003-0619-00. If an extracting tool is not available when removing one of these integrated circuits, pull slowly and evenly on both ends of the device. Try to avoid having one end of the integrated circuit disengage from the socket before the other, as this may damage the pins.

End-Lead Pin Connectors

The pin connectors used to connect ribbon cables to the interconnecting pins are clamped to the ends of the associated leads. To replace damaged end-lead pin connectors, remove the old pin connector from the end of the lead and clamp the replacement connector to the lead.

Some of the pin connectors are grouped together and mounted in a plastic holder; the result is that these connectors are removed and installed as a multi-pin connector. To provide correct orientation of this multi-pin connector when it is replaced, an arrow is placed on the circuit board and a matching arrow is molded into the plastic housing of the multi-pin connector. Be sure these arrows are aligned when the multi-pin connector is replaced. If the individual end-lead pin connectors are removed from the plastic holder, note the color of the individual wires for

correct replacement.

Scan Converter Removal

WARNING

Use extreme care when handling the Scan Converter tube. Protective clothing and safety glasses should be worn at all times. Do not attempt to remove the metal shield surrounding the tube body.

An exploded view of the CRT portion of the R7912 is shown in Fig. 4 in the Diagrams section at the rear of this manual. It will be helpful during CRT removal.

1. Remove the top and bottom covers from the R7912 and open the swing-out front panel.

2. Remove the black cover on the Video Preamplifier circuit board (A12).

3. Remove the round cover located on the rear panel. It is secured by three screws around its perimeter.

4. Reach through the opening at the rear panel and remove a portion of CRT shield located there.

5. Remove the large plugs at each end of the CRT.

6. Disconnect three sets of wires at the front of the CRT:

a. Unplug the focus coil connector P1821 on the Read Gun Supply board (A14).

b. Unplug black three-wire harmonica connector.

c. Unplug green harmonica connector (P1925) from the Cathode Regulator board (A13).

7. Disconnect any other visible connections (shield grounds, etc). Some additional connections are made under the Video Preamplifier board and termination board that will be removed later.

8. Remove the six circuit boards located above and below the CRT (A5, A6, A12, A13, A4, and A16). Note the connection sequence for each board as you remove it to facilitate reassembly.

The video Preamp board makes connection to the CRT with vertical pins. Use extreme care when removing the board. Unsolder black wire coming from the CRT to the board. This is the only wire unsoldered. Tuck the wire back down into the tube shield, out of the way.

The small termination board (A6) also connects to the CRT via vertical pins. Use caution when disconnecting the board from the tube pins.

9. Remove all screws securing the CRT shield to the R7912 mainframe. In addition to the mounting screws, there are three clamps holding the shield; two on the top and one on the bottom. Refer to the exploded view in Fig. 4. Do not unscrew the clamp screws completely or the backing plates may fall between the CRT and its shield.

10. Make certain all wires are disconnected from the CRT.

11. Carefully slide the CRT (with shield) out of the rear of the R7912. Rotating the tube and shield slightly during removal often helps.

Scan Converter Installation

The scan converter tube has a label affixed to its neck. Make a note of all information on the label. The voltage level listed there is characteristic of this particular tube, and is necessary for proper calibration.

1. Replace the tube in the R7912 mainframe, making sure that all attached wires are tucked into the shield during installation.

2. Replace the screws and clamps securing the CRT. Some alignment is necessary, so install all screws before tightening any.

3. Replace the black wire previously unsoldered.

4. Reinstall all circuit boards, starting with the Vertical Amplifier (A5) and the termination board (A6). Make sure that all connections to the CRT are properly restored. The Video Processor also has connections to the CRT.

5. Reconnect the horizontal drive terminals at the side of the CRT.

6. Reconnect the three sets of wires at the front of the CRT and attach the large plugs to each end of the tube.

Setting up the New Scan Converter

Before applying power to the R7912 after Scan Converter replacement, disconnect the ± 17 volt supply from the High Voltage circuit (P1637) and adjust the target level for the new tube. The voltage noted from the neck of the new scan converter tube is the target level. Step 12 of the Calibration Procedure (Section 6 of this manual) discusses target level adjustment.

After the target level is established, perform step 10 of the Calibration Procedure to align the Read gun. Then turn the R7912 OFF. Reconnect P1637 to restore high voltage. Turn the front-panel INTENSITY control fully counterclockwise - OFF. Restore power to the R7912. Perform step

24 of the Calibration Procedure to properly set the grid bias on the new tube. Follow step 24 with step 29 and then step 40, providing proper X-Y alignment for the writing beam.

This procedure provides a coarse adjustment for all major tube parameters, but recalibration of the instrument according to the procedures detailed in the Calibration section is necessary.

Recalibration After Repair

After any electrical component has been replaced, the calibration of that particular circuit should be checked, as well as the calibration of other closely related circuits. Since the low-voltage supply affects all circuits, calibration of the entire instrument should be checked if work has been done in the low-voltage supply, or if the power transformer has been replaced.

Instrument Repackaging

If the R7912 is to be shipped for long distances by commercial transport, it is recommended that it be repackaged in the original manner for maximum protection. The original shipping carton can be saved and used for this purpose. The repackaging illustration in the Mechanical Parts List shows how to repackage the R7912.

SECTION 5

SPECIFICATIONS

Introduction

The electrical specifications listed in the Performance Requirements column are valid over the stated environmental range for instruments calibrated at an ambient temperature of +20 degrees C to +30 degrees C and after a twenty-minute warmup unless otherwise noted. The electrical specifications listed in the Supplemental Information column indicate typical instrument operation and are not to be construed as requirements for proper instrument operation.

TABLE 5-1

Electrical Specifications

Characteristics	Performance Requirements	Supplemental Information
VERTICAL		
Deflection Factor	Compatible with all 7000-Series plug-in units.	
Low-Frequency Linearity	0.1 division or less compression or expansion of a center-screen, two-division signal positioned anywhere vertically within the electronic graticule area.	
System Bandwidth	Varies with vertical plug-in selected. See 7000-Series Oscilloscope Systems Specification.	

TABLE 5-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Vertical Centering		Within 0.5 division of electronic graticule center.
Isolation Signal to Graticule	At least 100:1 from dc to 250 megahertz and at least 40:1 from 250 megahertz to 500 megahertz.	
Delay Line		Permits viewing of leading edge of internal triggering signal.
	TRIGGERING	
Gain		X1 within 15%.
Bandwidth		Mainframe only: dc to 525 megahertz.
	HORIZONTAL	
Deflection Factor	Compatible with all 7000-Series plug-in units.	
DC Linearity	0.1 division or less compression or expansion with a center-screen two-division signal positioned anywhere horizontally within the electronic graticule area.	
Fastest Calibrated Sweep Rate	0.5 nanosecond/division	
Phase Shift Between Vertical and Horizontal Deflection Systems	2 degrees or less from dc to at least 35 kilohertz.	

TABLE 5-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
CHARACTER GENERATOR (Alphanumeric)		
Modes	Triggered at the end of the sweep, or externally single-shot controlled through pin 35 of the Digital Out connector.	
Character Height	0.25 division to 0.5 division.	
Total Characters (each row)	40 zeros displayed, no overlap with Q3416 removed.	
Horizontal Centering	1 zero or less to the left of zero graticule line. 1 zero or less to the right of 10th graticule line.	
Vertical Centering Top Row	Character baseline from the 7.3 division graticule line to the 7.4 division graticule line.	
Bottom Row	Character baseline from the 0.3 division graticule line to the 0.4 division graticule line.	
SIGNAL OUTPUTS		
+Gate Polarity		Positive going with baseline at zero volts within 0.1 volt (into 1 megohm).
Output Voltage Into 50 Ohms	Approximately 0.5 volt.	±10%.
Into 1 Megohm	Approximately 10 volts.	±10%.
Risetime Into 50 Ohms		2 nanoseconds or less.
Output Resistance		Approximately 950 ohms.

TABLE 5-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Video, Linear	1 volt into 75 Ω per full white signal.	
Video, Binary	Either 0 Volt ± 0.3 Volt or 1 Volt ± 0.1 Volt both into 75 ohms.	
Video, Composite	Binary Video plus Sync 1 Volt p-p nominal.	
Sync Out	At least 4 Volts into 75 ohms. Conforms to EIA document RS-170.	
Sync In (Loop Thru)	2 to 8 Volts.	
	VIDEO SYSTEM	
Bandwidth	At least 4 megahertz.	
Signal to RMS Noise	200:1.	
Resolution	At least 400 TV lines per picture width at 50% response.	Video signal is down less than 50% at TV LINEAR output.
TV Mode Ultimate Resolution	At least 500 TV lines when viewed on a Tektronix 632 Monitor or equivalent.	
Digital Mode Horizontal	400 lines.	Two 10 nanoseconds rise time signals delayed 1.25 nanoseconds with respect to each other will be digitized separately when sweep speed is 50 nanoseconds/division.

TABLE 5-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Vertical	320 lines.	A 50 millivolt squarewave will be resolved at 2 V/division.
	CRT	
Writing Rate ($10^{\circ}C$-$40^{\circ}C$)		At least 12.5 equivalent centimeters per nanosecond.
TV Mode	Must write a single shot 500 megahertz sine wave with an amplitude of 8 divisions peak-to-peak.	
Digital Mode	A single 1 nanosecond rise-time pulse with an amplitude of 8 divisions will be digitized.	
Digital Mode $0^{\circ}C$-$10^{\circ}C$	Same as above but 2 nanoseconds.	
Defects (bright)	6 maximum. No two on the same vertical line within $\pm 3^{\circ}$.	
Geometry	Within 0.1 division.	
Orthogonality	Adjustable to zero.	
	RAMP CIRCUIT	
Number of Steps (Digital Mode)	512 Active Horizontal and Vertical $\pm$ 0.	
	READ GUN	
Type	Mono Accelerator.	

TABLE 5-1 (cont)

WRITING GUN		
Type	Mono Accelerator.	
Cathode Potential Anode Grounded	-10 kilovolts	
Rise Time of Vertical Deflector	260 picoseconds	
EXTERNAL Z-AXIS INPUT		
Sensitivity	Two volts peak-to-peak provides trace modulation over full intensity range.	Approximately zero-volt input produces no intensity change.
Polarity of Operation	Positive-going signal decreases trace intensity; negative-going signal increases trace intensity.	
Input Resistance at DC		Approximately 550 ohms.
Maximum Safe Input Voltage		15 Volts (dc + peak ac)
CALIBRATOR		
Rise Time 4 V and 400 mV Open Circuit Measured with P6054 probe	50 nanoseconds or less.	
400 mV into 50 Ω	1.2 nanoseconds or less.	
40 mV into 50 Ω	1.2 nanoseconds or less.	
Fall Time 4 V and 400 mV Open Circuit Measured with P6054 probe	50 nanoseconds or less.	
400 mV, 40 mV into 50 Ω	5 nanoseconds or less.	

TABLE 5-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Stability		
20°C-30°C	0.1%.	
0°C to 40°C	0.5%.	
Aberrations		
Open Circuit	1% or less.	
Into 50 Ohms	+3%, =3% total 5%.	
Waveshape	Squarewave.	
Polarity	Positive-going with baseline approximately at ground.	
Output Voltage		
Open Circuit	4 Volts, 400 millivolts.	Selected by front-panel switch.
Into 50 Ohms	400 millivolts, 40 millivolts.	
Amplitude Accuracy 0°C to +40°C.		
4 V range	± 0.5%.	
400 mV range	± 1%.	
Repetition Rate	1 megahertz or 1 kilohertz	Selected with a movable jumper on the front panel board.
Accuracy	1 megahertz ± 0.1%. 1 kilohertz ± 20%.	
Duty Cycle	48% to 52%.	

TABLE 5-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
POWER SOURCE		
Line Voltage Range (AC RMS)		
115 Volts Nominal	90 to 132 Volts	Selected by rear-panel Line Selector assembly.
230 Volts Nominal	180 to 264 Volts	
Line Frequency		48 to 66 hertz.
Maximum Power Consumption		243 watts, 2.5 amperes at 60 hertz, 115 Volt line.
GRATICULE GENERATOR		
Mode	Triggered at end of sweep. Computer controlled via optional computer interface.	Time per Graticule: 3 milliseconds; locks out sweep, disables Z-axis.
Display	8 X 10 Graticule consisting of dot matrix giving major and minor division tick marks.	Each major division equals one division. Each minor division equals 0.2 major division.
Intensity	Controlled via front panel control. Graticule can be disabled via same control.	

SECTION 6

CALIBRATION

Introduction

To assure instrument accuracy, check the calibration of the R7912 every 1000 hours of operation or every six months, if used infrequently. Before complete calibration, thoroughly clean and inspect the instrument as outlined in the Maintenance section.

Tektronix Field Service

Tektronix, Inc. provides complete instrument repair and recalibration service at local Field Service Centers and at the Factory Service Center. Contact your local field office or representative for further information.

Performance Check

The performance of the R7912 can be checked by performing only the Check-steps marked with a check. Performing the steps marked with a check indicates that the instrument is checked against the tolerances listed as a Performance Requirement (see Specification section).

Limits and tolerances given in other Check-steps are calibration guides and should not be interpreted as instrument specifications. Operator front panel adjustments are adjusted as part of the Performance Check procedure.

Calibration

To verify proper calibration of the R7912 and to prevent unnecessary recalibration of the entire instrument, perform the Adjust- portion of a step only if the tolerance given in the Check- part of the step is not met.

For best overall instrument performance when performing a complete calibration procedure, make each adjustment to the exact setting even if the Check is within allowable tolerance.

Partial Calibration

A partial calibration can be performed by first performing the "Preliminary Procedure for Calibration"; then, start with the first major step preceding the desired adjustment.

Where interaction of adjustments occurs, an "INTERACTION" note is placed prior to the affected steps.

TEST EQUIPMENT REQUIRED

General

The following test equipment and accessories, or their equivalent, is required for complete calibration of the R7912. Specifications given for the test equipment are the minimum necessary for accurate calibration. Therefore, the specifications of any test equipment used must meet or exceed the listed specifications. All test equipment is assumed to be correctly calibrated and operating within the listed specifications. Detailed operating instructions for the test equipment are not given in this procedure. Refer to the test equipment instruction manuals if more information is needed.

Test equipment required to complete each major numbered step is given at the beginning of the step. This list contains the name of the test equipment only. Refer to the main Test Equipment Required List, Table 6-1 for complete specifications.

Special Calibration Fixtures

Special Tektronix calibration fixtures are used in this procedure only where they facilitate instrument calibration. These special calibration fixtures are available from Tektronix, Inc. Order by part number through your local Tektronix Field Office or representative.

A special R7912 Calibration Kit is available that supplies some of the necessary accessories as well as the R7912 Video Calibrator. Refer to the Test Equipment Required List for more information.

Calibration Equipment Alternatives

All of the listed test equipment is required to completely check and adjust this instrument. The Calibration procedure is based on the first item of equipment given as an Example of Applicable Test Equipment. When other equipment is substituted, control settings or calibration setup may need to be altered slightly to meet the needs of the substitute equipment. If the exact item of test equipment is not available, first check the Specification column carefully to see if any other equipment is available which might suffice. Then check the Usage column to see what this item of test equipment is used for. If used for a check or adjustment which is of little or no importance to your measurement requirements, the item and corresponding step(s) can be deleted.

TABLE 6-1

Description	Minimum Specifications	Usage	Examples of Applicable Test Equipment
1. Test Oscilloscope	Dual Trace; Vertical sensitivity, 5 mV to 5 volts; Input impedance, 10 megohm; Delaying time base.	Used throughout calibration procedures	a. Tektronix 7603 equipped with: 7A13 differential comparitor, 7A18 dual trace amplifier, 7B53A Time Base, and two P6006 X10 probes.
2. Time Base Plug-in	Readout equipped; sweep speed, to 0.5 ns/div; triggering, to 500 MHz.	Used with R7912 to provide sweep	a. Tektronix 7B92A Time Base. b. Any Tektronix 7B-- series time base plug-ins.
3. Amplifier plug-in	Tektronix 7000 Series Compatible	Used with R7912 throughout calibration procedures	a. Tektronix 7A19 Amplifier b. Any Tektronix 7A-- series amplifier plug-ins.
4. TV Monitor	Display shift capabilities, calibrated contrast and brightness controls.	Use throughout procedures to provide R7912 display.	a. Tektronix 632 Picture Monitor
5. Signal Standardizer plug-in	Produces gain check, step response and constant amplitude waveforms.	Used throughout calibration to standardize the R7912	a. Tektronix 067-0587-01 Calibration Fixture.
6. Pulse Generator	Must produce waveform shown in Fig. 1.	Triggers ASCII Converter circuit.	a. Tektronix PG502 or equivalent.
7. Time Mark Generator	Markers to 2 ns and triggers to 0.1 us.	Used in step 48 Timing Accuracy	a. TG 501 Time-Mark Generator[1]. b. Tektronix 2901 Time Mark Generator
8. HF Signal Generator	Frequency range to 500 MHz, reference frequency below 10 MHz.	Used in step 52. Vertical Amplifier Bandwidth check.	a. SG504 Signal Generator[1]

[1]Requires TM 500-Series Power Module.

TABLE 6-1 (cont.)

Description	Minimum Specifications	Usage	Examples of Applicable Test Equipment
9. Digital Voltmeter	Range from 2 volts to 1 KV; accuracy 0.1%	Used in several procedures for precision DC measurements.	a. Tektronix DM-501 Digital Multimeter[1]. b. Tektronix 7D13 with Test Oscilloscope.
10. R7912 Calibration Aid	Contains Video Calibrator, Plug-in Card Extender, and necessary cables used for calibrating the R7912	Used throughout the calibration	a. Tektronix 067-0713-00 R7912 Calibration Kit
11. High Voltage Probe	Attenuation ratio, 1000:1; maximum input voltage 20 KV.	Used in step 23, -10 KV adjust.	a. Tektronix P6015 Probe
12. 1350 Memory Display Unit	D/A converter calibration fixture	Used in step 57, 58, 59.	a. 1350 Memory Display Unit.
13. Display Monitor	Storage capability	Used in step 57, 58, 59.	a. Tektronix 611 Storage Display Monitor.
14. Low Frequency Signal Generator	Frequency range to 35 Kilohertz	Used in step 49.	a. Tektronix SG 502 RC Oscillator[1]
15. Plug-in Extender	Provides connection to increase trigger system outputs.	Trigger selector adjustment.	a. Tektronix 067-0589-00 Calibration Fixture.
16. 2 ea 75-ohm Feedthrough Termination			a. Tektronix 011-0055-00 75-ohm Feedthrough Termination.
17. One test-clip for 16-pin DIP integrated circuits; also miscellaneous connector cables, etc.			
18. 12-inch test Lead		Used in step 41A.	a. Tektronix 003-0507-00

[1]Requires TM 500-Series Power Module.

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CALIBRATION PROCEDURE

General

The following procedure is arranged so that the R7912 can be calibrated with the least interaction of adjustments and reconnection of equipment. The control settings and test equipment setup throughout the major numbered sections continue from the preceding step(s) unless otherwise noted.

Adjustment locations are given on the pull-out pages in the diagram section. Also shown on the pull-out page is a board locator used to help find the board(s) shown on that page.

NOTE

Control titles which are printed on the front panel of the R7912 are capitalized in this procedure (e.g. INTENSITY). Internal adjustments and associated equipment controls are initially capitalized only (e.g. oscilloscope Vertical Mode).

Preliminary Procedure for Calibration

1. Remove the top and bottom covers of the instrument.

2. Insert the Time Base unit in the R7912 Horizontal (right) compartment.

3. Connect the R7912 to a suitable power source.

4. Perform the following preliminary control settings.

Set the R7912 controls as follows:

INTENSITY	fully counterclockwise (off)
FOCUS	mid-range
GRATICULE (Option 6)	fully counterclockwise
READOUT	OFF
OPERATING MODE	NON-STORE
INTERNAL GRATICULE SELECTOR	Full Graticule

CAUTION

The writing beam intensity is critical. Excessive intensity can permanently damage the scan converter target. Many portions of the calibration procedure require adjustment of intensity or sweep speed. Remember that reducing sweep speed has the same effect as increasing intensity. Always reduce intensity before reducing sweep speed.

5. Turn the R7912 on and allow 20 minutes warmup before proceeding.

6. If the R7912 is equipped with Option 13 (625 line, 50 HZ field rate for TV mode), replace U2743 and U2755 (programmers) on the Sync Generator card with the alternates supplied in the R7912 Calibration Kit. Figure 8-1 locates the integrated circuits.

NOTE

This instrument should be calibrated at an ambient temperature of +20 degrees C to +30 degrees C for best overall accuracy. The performance of the instrument can be checked at any temperature within the 0 degrees C to +40 degrees C range.

POWER SUPPLY CALIBRATION

EQUIPMENT REQUIRED

Precision DC Voltmeter

Three-inch screwdriver

Set the controls as given in the Preliminary Procedure for calibration. Leave all plug-in compartments vacant. Pull out Fig. 8-31 at the rear of the manual. The illustrations there will locate test points and adjustments for this portion of the calibration.

1. Check/Adjust Inverter Control

a. Connect the precision DC voltmeter between 130 Volt test point, located on Power Distribution board, and chassis ground.

b. CHECK - Meter reading; 130 Volts ±1.3 Volts. If the meter reading is within the given tolerance, proceed to step 2.

c. ADJUST - Inverter control R1293 on the Cap-Rectifier board to 130 Volts. R1293 is accessible through a hole in the bottom of the power supply after it has been removed from the R7912.

NOTE

Any change in this adjustment may affect operation of all circuits within the instrument.

2. Adjust -50 Volt Power Supply

a. Connect the precision DC voltmeter between TP -50 V and TP GND SENS on the Low Voltage Regulator board.

b. CHECK - Meter reading; -50 volts ±0.2 volt.

c. ADJUST - -50 volts adjustment R1513 for a meter reading of -50 volts within 0.2 volt.

d. INTERACTION - Check steps 1 and 2. Any change in R1513 (-50 volts adjustment) may change the 130 volt supply (Inverter control test point). A change in this adjustment may also affect operation of all circuits within the R7912.

3. Check Remaining Power Supply Voltages

Check - Table 6-2 lists the low-voltage supplies and their tolerances. Check each supply with the precision DC voltmeter. The 4.9 Volt test point is located on the +365 Volt and 4.9 Volt Regulator Board. The remaining power supply test points are located on the Power Distribution Board.

TABLE 6-2

SUPPLIES AND TOLERANCE

Supply	Tolerance
365 volts	±14.6 volts
-15 volts	±0.15 volt
+5 volts	±0.15 volt
+15 volts	±0.15 volt
+50 volts	±0.50 volt
4.9 volts	+0.35 -0.15 volt

Refer to Fig. 8-32.

4. Control Illumination Check

a. Insert a time base plug-in into the right-hand compartment.

b. Check that the intensity of the plug-in mode switches varies with the position of the Control Illumination switch. The rear most position of the switch should turn the lights off.

c. Remove the time base plug-in.

SYNC GENERATOR

EQUIPMENT REQUIRED

TV Monitor

Plug-in Card Extender

2- 75 ohm BNC Cables

Refer to Fig. 8-32 for location of adjustment and test points used in the following procedure.

5. Sync Pulse width Check/Adjust

a. Turn R7912 POWER switch off.

b. Open the R7912 front swing-out panel. Refer to the Maintenance section of this manual for procedure.

c. Place Sync Generator board on Plug-in Card Extender.

d. Turn POWER switch ON.

e. Connect R7912 SYNC OUT to the TV Monitor Video Input, and the VIDEO LINEAR to the TV Monitor Sync Input. Set the TV Monitor for an internal sync.

f. Shift the TV Monitor vertical and horizontal display (push the VERT and HORIZ Display Shift buttons). Note a displayed sync pattern similar to Fig. 6-1.

g. Check - for a stable display within the area circled in Fig. 6-1.

h. Adjust - C2783 on the Sync Generator for a stable display within the area circled in Fig. 6-1.

i. Turn the R7912 POWER off. Remove Plug-in Card Extender and return the Sync Generator board to its compartment. Remove the vertical and horizontal display shifts.

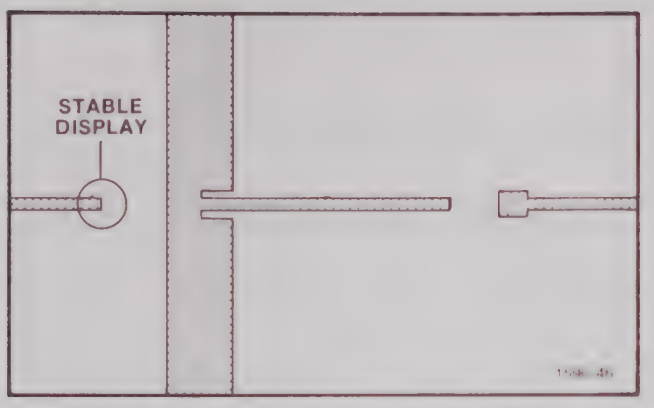

Fig. 6-1. TV sync pattern.

j. Reconnect VIDEO LINEAR and SYNC on TV Monitor.

Use the following procedure if a TV Monitor with vertical and horizontal display shifts is not available. Perform steps a thru j.

5 ALTERNATE. Sync Pulse width Check/Adjust (alternate Procedure)

a. Connect R7912 SYNC OUT to Channel-One of the Test Oscilloscope with a BNC shielded cable terminated with 75 ohms. Set the Channel-1 vertical sensitivity for 1 volt/division.

b. Connect the Test Oscilloscope Channel-2 probe to TP465 on the X and Y Ramp generator. Set the Channel-2 vertical sensitivity for 2 volts/division.

c. Set the Test Oscilloscope sweep rate to 0.1 ms/ division.

d. Set the Test Oscilloscope triggering mode to Channel-2. Set the display mode to Channel-1.

e. Internally trigger the Test Oscilloscope on the negative going slope of the Channel-2 signal.

f. Trigger the Test Oscilloscope on the negative going slope to display the waveform shown in Fig. 6-2.

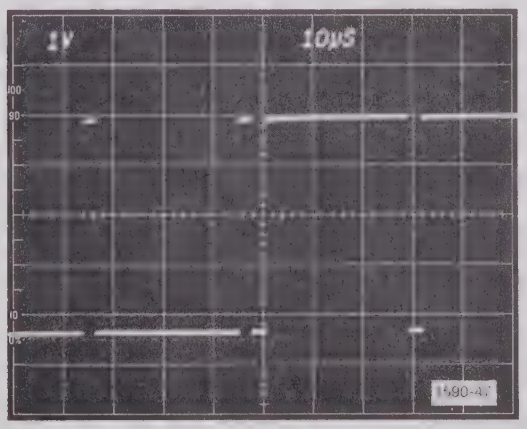

Fig. 6-2. Sync pulse width.

g. Set the Test Oscilloscope sweep X10 magnifier on and horizontally position the display to view about two serrated pulses and two equalizing pulses.

h. Check - that the width of the serrated pulses and the equalizing pulses are equal.

i. Adjust - C2783 (sync board must be extended) so the width of the serrated pulses and the equalizing pulses are equal.

j. Disconnect Test Equipment.

DATA TIMER

EQUIPMENT REQUIRED

Test Oscilloscope

Plug-in Card Extender

IC Test Clip

Refer to Fig. 8-32.

6. Holdoff Pulse Width

a. With power off, place the Data Timer board on Plug-in Card Extender.

b. Turn the POWER switch to ON.

c. Set the R7912 OPERATING MODE switch to DIGITAL.

d. Connect the Test Oscilloscope probe to pin 9 of U2814.

e. Set the Test Oscilloscope vertical sensitivity to obtain a deflection of 1 volt/division. Set the Test Oscilloscope sweep rate to 0.2 microsecond/division (trigger - slope).

f. Check - for a stable display with a pulse width of approximately 1.6 microseconds.

g. Adjust - R2810 for a pulse width of approximately 1.6 microseconds.

h. Turn the R7912 power off and remove the probe and IC Test Clip. Remove the Plug-in Card Extender and return the Data Timer board to its compartment. Close swing-out front panel. Turn the power on.

Y RAMP GENERATOR

EQUIPMENT REQUIRED

Test Oscilloscope

Refer to Fig. 8-32.

7. Y Ramp Bias Check/Adjust

a. Set the R7912 OPERATING MODE to NON STORE.

b. Connect the Test Oscilloscope probe to TP 360 on the X and Y Ramp Generator.

c. Set the Test Oscilloscope vertical sensitivity to 50 millivolts/division. Set the Vertical Mode to DC. Obtain the ground reference at graticule center.

d. Check - for a display of 0 volts ± 10 millivolts.

e. Adjust - R359 for a display of 0 volts.

f. Disconnect the Test Oscilloscope.

8. Y Ramp Hold Ratio Check/Adjust

a. Set the R7912 OPERATING MODE to DIGITAL.

b. Connect the Test Oscilloscope probe to TP 325. Set the Test Oscilloscope vertical sensitivity for 1 volt/division.

c. Set the Test Oscilloscope sweep rate to .1 microsecond/division.

d. Check - Test the Oscilloscope display for a symmetrical 5 megahertz waveform.

e. Adjust - R322 for a symmetrical 5-megahertz (Period of 200 ns) waveform.

f. Disconnect the Test Oscilloscope.

READ GUN

EQUIPMENT REQUIRED

Digital Voltmeter

Two 75 ohm coaxial cables

Refer to Fig. 8-33.

9. Read Gun Anode Voltage Check/Adjust

a. Set the R7912 to Non-Store.

b. Set the Digital Voltmeter range to 1 KV.

c. Connect the Digital Voltmeter positive probe to TP1849 on the Read Gun Supply board, and the negative probe to ground.

d. Check - for a Digital Voltmeter reading of +259 volts $\pm$ 1 volt.

e. Adjust - R1827 for a Digital Voltmeter reading of +259 volts.

f. Disconnect the Digital Voltmeter.

10. Read Gun X and Y Alignment Adjust

a. Connect the R7912 VIDEO LINEAR and SYNC OUT to the TV Monitor inputs via 75-ohm cables.

b. Unplug multi-pin connector P1821 on the Read Gun Supply board, rotate it one-half turn, then plug onto circuit board so that the arrow on the multi-pin connector does not align with the arrow marked on the circuit board.

c. Adjust - R1910 Y Alignment and R1930 X Alignment on the Read Gun Cathode Regulator Board for a bright, sharp, well-defined ring around the edge of the TV Monitor display. Concentrate on adjusting for a high-contrast ring and disregard the other facets of the display.

d. Return the multi-pin connector, P1821, to its original position so that the arrow on the multi-pin connector aligns with the arrow marked on the circuit board.

11. Read Gun Cathode Check/Adjust

a. Connect the Digital Voltmeter probes between the two 1k test points on the Read Gun Cathode Regulator Board.

b. Check - for a Digital Voltmeter reading of 3.75 volts $\pm$ 0.18 volt.

c. Adjust - R1894 Cathode Current to 3.75 volts.

d. Disconnect the Digital Voltmeter.

VIDEO PREAMPLIFIER

EQUIPMENT REQUIRED

Test Oscilloscope

50-ohm feedthrough terminator

R7912 Calibration Aid

Digital Voltmeter

Refer to Fig. 8-33.

Preliminary Video Set-up:

CAUTION

Do not use magnetized tools when working in the vicinity of the R7912 tube shield. Inadvertently magnetizing the tube shield can be detrimental to instrument performance.

a. Remove the black metal shield covering the Video Preamplifier circuit board.

b. Connect the short strap supplied with the R7912 Calibration Kit to connector pins P1946 and P1956 on the Video Pre-amp.

c. Connect the Calibration Aid Cal In 4 V cable to the R7912 CALIBRATOR. Set the CALIBRATOR switch to IN 4.0 V (1 MHz).

d. Connect the Video Calibrator power plug to the R7912 PROBE POWER connector.

e. Set the Video Calibrator Mode switch to Preamp Pulse.

f. Unplug the cable connected to J1994. Connect a Tektronix-to-BNC cable (supplied with the R7912 Calibration Kit) from J1994 to Channel-1 of the Test Oscilloscope via a 50-ohm feedthrough terminator.

g. Connect a Tektronix-to-BNC cable (supplied with the R7912 Calibration Kit) from J1947 to the Video Calibrator Output connector.

12. Target Level Check/Adjust

a. Connect the Digital Voltmeter positive probe to the end of resistor R1953 nearest to R1952. Connect the negative probe to ground.

NOTE

The Target Level voltage setting is unique to the specific tube used in the instrument. This voltage level is determined at the factory, then printed on the tube. This number is located near the writing gun end of the tube (toward the rear of the instrument).

b. Obtain the Target Voltage level. It will be necessary to remove the tube shield at the rear of the instrument. Refer to that procedure in the Maintenance section of this manual.

c. Subtract 6 volts from the target level voltage (obtained in step b). This corrects for the cathode potential.

d. Check - for a Digital Voltmeter reading equal to the corrected voltage obtained in step c $\pm$ 1%.

e. Adjust - R1952 for a Digital Voltmeter reading equal to the corrected voltage obtained in step c.

f. Disconnect the Digital Voltmeter.

13. Video Preamplifier Output Level Check/Adjust

a. Perform the Preliminary Video Set-up procedure (steps a-g at the front of this section).

b. Set the Test Oscilloscope vertical sensitivity to 50 millivolts/division.

c. Check - Test Oscilloscope display for a waveform centered about 0 volts ± 10 millivolts.

d. Place the black metal shield (removed in Preliminary Video Set-up procedure) upside down on the four metal posts of the Video Preamplifier. This simulates the stray capacitance of a normal environment.

e. Adjust - R1979 so that Test Oscilloscope displayed waveform is centered about 0 volts (Fig. 6-3).

14. Video Preamplifier Gain Check

a. Check - that the total amplitude of the displayed waveform is 200 millivolts ± 10 millivolts. This verifies a gain of 10 through the system.

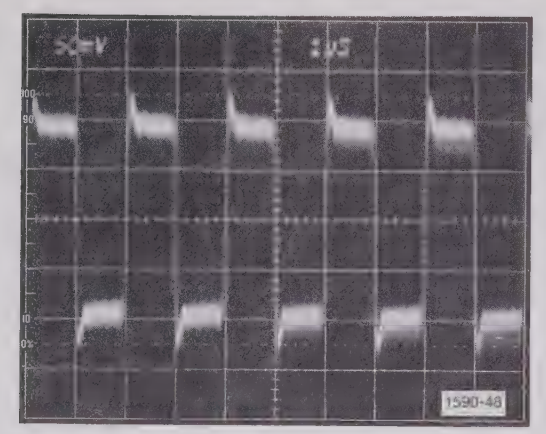

Fig. 6-3. Video preamp output level.

15. Video Preamplifier High Frequency Compensation Check/ Adjust

a. Place the black metal shield (removed in Preliminary Video Set-up procedure) upside down on the four metal posts of the Video Preamplifier. This simulates the stray capacitance of a normal environment.

b. Check - front corner of the Test Oscilloscope display for aberrations of less than ± 5%.

c. Adjust - R1972 for a Test Oscilloscope display with the lease oscillations. Recheck step b.

d. Adjust - R1957 so that aberrations are within ± 5%, 10% total. This adjustment requires that resistor R1957 be unsoldered, physically moved toward or away from the circuit board, then re-soldered. Do not perform this adjust-

ment unless the specifications in step b cannot be met by adjusting R1972. Raising R1957 (further from the board) will cause the front edge of the pulse to roll-off.

CAUTION

R1957 is fragile. Do not try to adjust it by bending its leads.

e. Disconnect all test equipment. Replace cable to J1994. Remove the shorting strap and replace black metal shield.

VIDEO PROCESSOR

EQUIPMENT REQUIRED

R7912 Calibration Aid

TV Monitor

Video Calibrator

Test Oscilloscope

Refer to Fig. 8-34.

16. Clamp Level Check/Adjust

NOTE

The accuracy of this Check/Adjust is highly dependent upon temperature. Allow the R7912 to fully warm up and stabilize (approximately 2 to 3 hours) before proceding.

a. Plug the Video Calibrator power cable into the R7912 PROBE POWER connector. Set the Mode switch to Cathode Blanking pulse.

b. Connect the Video Calibrator Sync In probe to TP2757 on the Sync Generator circuit board. TP2757 is accessible from the top of the instrument.

c. Connect the Video Calibration output of the Video Calibrator to J1877 on the Read Gun Cathode Regulator board by using a Tektronix-to-BNC cable (supplied with the R7912 Calibration Kit).

d. Connect the TV Monitor and observe the blanking pulse at the center of the screen. This blanked portion of the TV line will be barely visible.

e. Set the Test Oscilloscope vertical sensitivity for 50 millivolts/division and the sweep rate to 1 millisecond/division.

f. Connect the Test Oscilloscope probe to the A end of R1877 and note the baseline voltage level.

g. Move the Test Oscilloscope probe to side B of R1877. Adjust the Video Calibrator DC Level to the level noted in step f.

h. Externally trigger the Test Oscilloscope with the Video Calibrator Trigger Output.

i. Move the Test Oscilloscope probe to TP2223 on the Video processor.

j. Observe the cathode pulse approximately 8 milliseconds before the first vertical blanking pulse which is intensified in Fig. 6-4 and expanded in lower trace; adjust triggering to observe the cathode blanking pulse.

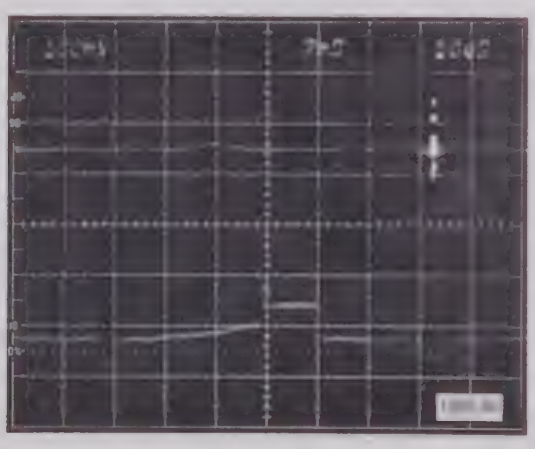

Fig. 6-4. Cathode blanking pulse.

k. Set the Test Oscilloscope sweep rate to 10 microseconds/division and record the amplitude of the cathode blanking pulse which is expanded in Fig. 6-5. This value is typically 75 millivolts to 100 millivolts after 2 to 3 hours warmup.

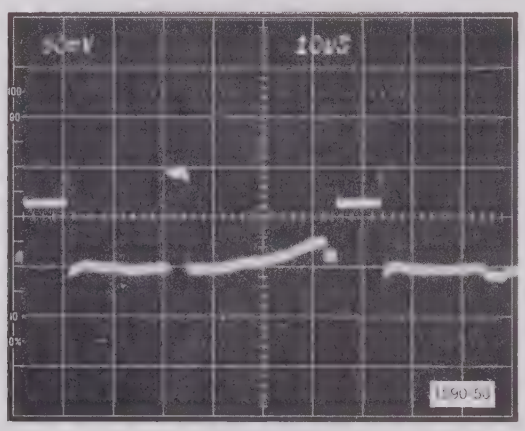

Fig. 6-5. Cathode blanking pulse expanded.

l. Move the Test Oscilloscope probe to TP2208 on the Video Processor.

m. Check - that the DC level is equal to the cathode blanking pulse amplitude noted in step k.

n. Adjust - R2201 (Clamp Level) for a DC level equal to the cathode blanking pulse amplitude (recorded in step k).

o. Disconnect the Test Oscilloscope and Video Calibrator.

Alternate Procedure for Setting Clamp Level

A trigger pulse generator may be substituted for the Video Calibrator. The process is to trigger the pulse generator on the negative-going edge of the signal at TP2757 on the Sync Generator card. The resulting pulse must be as shown in Fig. 6-6. This pulse is connected to J1877 on the Read Gun Cathode Regulator.

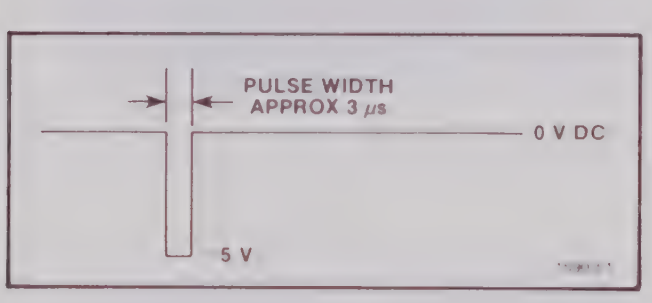

Fig. 6-6. Trigger pulse generator output.

If a video calibrator is not available, substitute the above process for steps a, b, c, and d.

17. Video Processor DC Schmitt Check/Adjust

(Should be performed under actual or simulated operating conditions.)

a. Install a Time Base in the R7912 horizontal compartment.

b. Set the R7912 MODE switch to DIGITAL.

c. Rotate the INTENSITY control fully ccw.

d. Connect the probe from Channel-1 of the Test Oscilloscope to TP2232 on the Video Processor board. Set the Channel-1 vertical sensitivity for 200 millivolts/division.

e. Connect the probe from Channel-2 of the Test Oscilloscope to TP2277. Set the Channel-2 vertical sensitivity for 1 V/division.

f. Set the Test Oscilloscope sweep rate to 20 microseconds/division.

g. Internally trigger the Test Oscilloscope with the signal from Channel-1 vertical. Set the Test Oscilloscope vertical Mode to Alternate.

h. Rotate the R7912 INTENSITY control clockwise to obtain a Channel-1 peak deflection of 400 millivolts (two divisions).

i. Check - the Channel-2 display for a solid pulse that is time related with Channel-1 (Fig. 6-7).

j. Adjust - R2266 (DC Schmitt) until solid pulse appears.

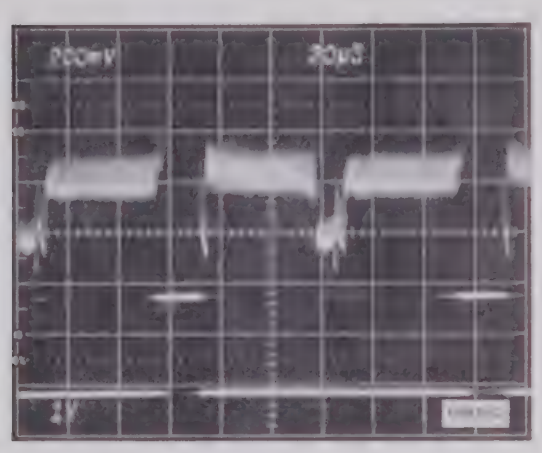

Fig. 6-7. [illegible]

18. Composite Video Check

a. Connect the R7912 COMPOSITE VIDEO connector to the TV Monitor video input via a 75-ohm BNC cable.

b. Shift the TV Monitor vertical and horizontal display (push the Vert and Horiz Display Shift buttons). If display shifts are not available on your monitor, set the vertical hold to roll the pattern slightly.

c. Check - for a dark screen with a standard television sync pattern (Fig. 6-8).

d. Disconnect the TV Monitor.

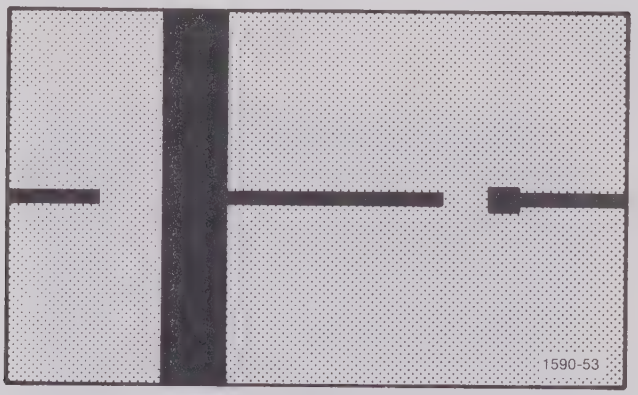

Fig. 6-8. TV sync pattern.

19. X Symmetry and Gain (Shading Correction) Check/Adjust

a. Set the R7912 OPERATING MODE to DIGITAL.

b. Connect the Test Oscilloscope probe to TP2232 on the Video Processor.

c. Set the Test Oscilloscope vertical sensitivity to 100 millivolts/division (use bandwidth limit if available). Set the sweep rate to 2 milliseconds/division.

d. Internally trigger the Test Oscilloscope.

e. Check - Test Oscilloscope display for a flat baseline (Fig. 6-9).

f. Adjust - R2127 and R2147 to obtain a flat baseline.

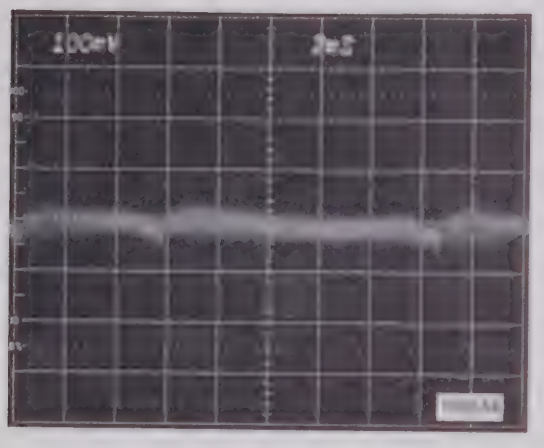

Fig. 6-9. Y symmetry and gain.

20. Y Symmetry and Gain (Shading Correction) Check/Adjust

a. Set the Test Oscilloscope sweep rate to 20 microseconds/division.

b. Internally trigger the Test Oscilloscope.

c. Check - for a Test Oscilloscope display with a flat baseline (Fig. 6-10).

d. Adjust - R2167 and R2187 on the Video Processor for a flat baseline (Fig. 6-10).

e. Disconnect all test equipment. Set the R7912 OPERATING MODE to NON-STORE.

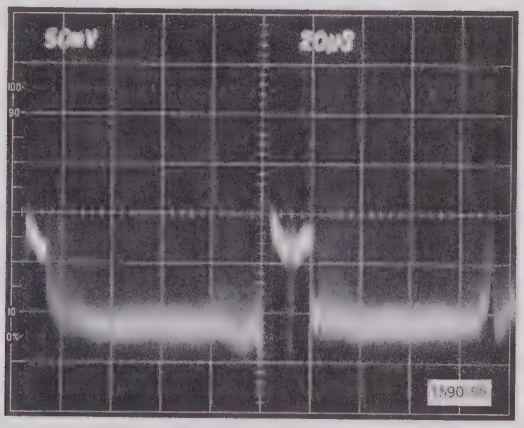

Fig. 6-10. Y symmetry and gain.

TRIGGER BUFFER

EQUIPMENT REQUIRED

Signal Standardizer

Test Oscilloscope

Plug-in Extender (Tektronix Part Number 067-0589-00)

21. Trigger Buffer Centering Check/Adjust

a. Insert the Signal Standardizer Plug-in into the R7912 Left Plug-in Compartment. Set to Vert or Horiz, Common Mode.

b. Insert the Plug-in Extender into the R7912 Right Plug-in Compartment.

c. Connect the (+) trigger output (marked A20 on the Plug-in Extender) to Channel-1 of the Test Oscilloscope via a 36-inch cable and a 50-ohm feedthrough terminator.

d. Connect the (-) trigger output (marked B20 on the Plug-in Extender) to Channel-2 of the Test Oscilloscope via a 36-inch cable and a 50-ohm feedthrough terminator.

e. Set the Test Oscilloscope Channel-1 and Channel-2 vertical sensitivity for 50 millivolts/division and the coupling to DC. Set the Channel-2 mode to Invert.

f. Set the Test Oscilloscope Vertical Mode to Add. Switch the Channel-1 and Channel-2 Inputs to Gnd. Position the trace to the graticule centerline. Return the Inputs to DC.

g. Check - for a Test Oscilloscope display of Zero Volt ± 25 millivolts.

h. Adjust - R4563 Trigger Buffer Centering for a Test Oscilloscope display of zero volts.

22A. Trigger Buffer Gain Check

a. Select Channel-1 for the Test Oscilloscope trigger source.

b. Set the Signal Standardizer to Triggering Gain.

c. Check - Test Oscilloscope display for a series of lines spaced at 50 millivolt intervals ± 7.5 millivolts.

d. Disconnect the Test Equipment.

22B. Trigger Buffer Bandwidth Check

a. Install the Time Base Plug-in (7B92A or equivalent) into the R7912 Right plug-in compartment.

b. Install the Amplifier plug-in (7A19 or equivalent) into the R7912 Left plug-in compartment. Set the vertical sensitivity to 10 millivolts/division.

c. Connect the High Frequency Signal Generator output to the Amplifier plug-in input via a 50-ohm coaxial cable.

d. Set the HF Signal Generator to obtain a 500-megahertz, 10 millivolt P-P signal.

e. Check - that the Time Base plug-in can be internally triggered.

f. Disconnect all test equipment.

-10 KV POWER SUPPLY

EQUIPMENT REQUIRED

HV Probe
Digital Voltmeter

Refer to Fig. 8-35.

23. -10 KV Check/Adjust

a. Turn the instrument off. Remove the R7912 rear tube shield. Refer to the procedure given in the Maintenance section of this manual.

b. Disassemble the tube socket by prying the clamp loose, see Fig. 6-11a.

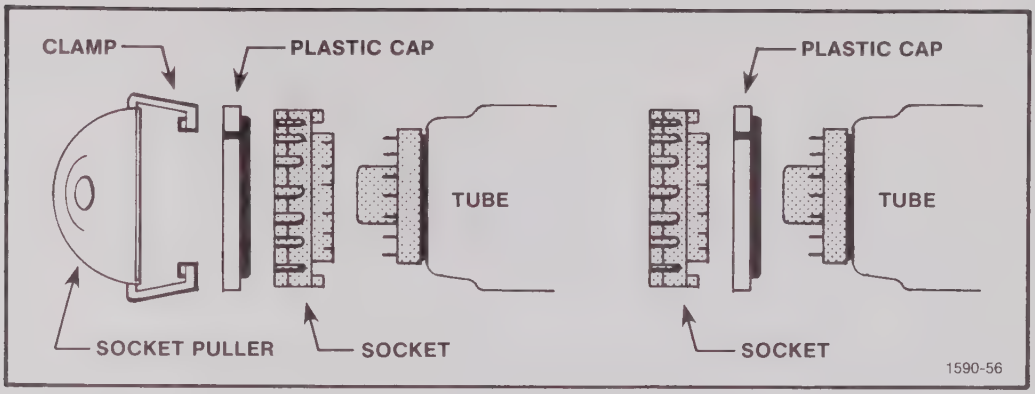

Fig. 6-11. CRT socket.

c. Unplug the socket and place the plastic cap between the tube and the socket as shown in Fig. 6-11b.

d. Connect the HV Probe to pin 2 of the tube socket. Connect the ground strap to a convenient chassis ground.

e. Connect the cable end of the HV Probe to the Digital Voltmeter. Set the Digital Voltmeter range to 20 volts (to obtain an overall range of 20 KV).

f. Turn the R7912 POWER switch to ON.

g. Check - for a Digital Voltmeter reading of -10 volts $\pm$ 0.1 volt (-10 KV $\pm$ 100 volts).

h. Adjust - R1609 on the Z-Axis circuit board for a Digital Voltmeter reading of -10 volts (-10 KV).

i. Turn the R7912 POWER switch to OFF.

WARNING

Wait for Digital Voltmeter reading to decay to 0.00 volts before proceeding further.

j. After the Digital Voltmeter reading has decayed to 0.00 volts, remove the HV Probe, reassemble the tube socket, and plug the tube socket onto the tube. Replace the tube shielding according to instructions given in the Maintenance section of this manual.

k. Turn the R7912 POWER switch to ON.

WRITING GUN

EQUIPMENT REQUIRED

Test Oscilloscope

TV Monitor

Refer to Fig. 8-35.

24. Grid Bias Check/Adjust

a. Connect the Test Oscilloscope probe to TP1723 on the Z-Axis board.

b. Set the Test Oscilloscope vertical sensitivity to 1 volt/division. Set the sweep rate to 10 microseconds/division.

c. Set the R7912 Time Base sweep rate to 0.2 second/division.

d. Turn the R7912 INTENSITY control fully counterclockwise. Position the Test Oscilloscope trace to the bottom graticule line to establish a reference baseline.

e. Set the R7912 INTENSITY control to obtain a Test Oscilloscope vertical display of 3.0 volts above reference.

f. Check - that the TV Monitor display is just visible.

g. Adjust - R1654 for a TV Monitor display that is just visible.

25. Protection Circuit Check/Adjust

a. Turn the R7912 INTENSITY control fully counterclockwise. Set the Test Oscilloscope vertical sensitivity to 2 volts/division and position the trace to the bottom graticule line to establish a reference baseline.

b. Turn the R7912 INTENSITY control clockwise until the TV Monitor display disappears and the DECREASE INTENSITY indicator starts blinking.

c. Check - that the Test oscilloscope vertical display amplitude is 11 volts $\pm$ 0.5 volts. DO NOT set the INTENSITY control for a Test Oscilloscope display of greater than 11.5 volts above the reference

d. Adjust - R1752 1/8 turn counterclockwise if the amplitude checked in step b is greater than 11 volts or 1/8 turn clockwise if the amplitude checked in step c is less than 11 volts. Repeat steps a, b, and c until the amplitude checked in step c is 11 volts, or 8 volts for instruments with serial number B010179 and below.

e. Turn the INTENSITY control clockwise until the trace deflects off screen and the DECREASE INTENSITY light blinks.

f. Check - that the trace remains off screen and the DECREASE INTENSITY light continues to blink after depressing the BEAMFINDER button.

g. Rotate the INTENSITY control fully counterclockwise.

h. Disconnect the Test Oscilloscope, and set the R7912 sweep rate to 1 millisecond/division.

26. Focus Adjust

a. Obtain a TV Monitor display covering a large portion of the screen. An Electronic Graticule or Calibrator display can be used.

b. Adjust - Front panel FOCUS control, R1780 (astigmatism), R1782 (shield), and R1809 (Mag focus on Reading Gun Supply board) to obtain a sharp focused display over the entire screen area. This adjustment directly effects vertical and horizontal resolution and writing rate.

c. Turn the Graticule and Readout off. Set the INTENSITY fully counterclockwise.

Z-AXIS

EQUIPMENT REQUIRED

Test Oscilloscope

TV Monitor

Refer to Fig. 8-35.

27. Z-Axis Transient Response Check/Adjust

a. Connect the Test Oscilloscope probe to TP1722 on the Z-Axis board.

b. Set the Test Oscilloscope vertical sensitivity to 50 millivolts/division. Set the sweep rate to 0.02 microsecond/division.

c. Set the R7912 Time Base sweep rate to 0.1 microsecond/division.

d. Unplug the multi-pin connector, P1637, on the HV.OSC. board. This removes power to the HV Oscillator, protecting the scan converter tube during this procedure.

e. Turn the R7912 INTENSITY control clockwise to obtain a Test Oscilloscope display of six (6) vertical divisions.

f. Check - for a slightly peaked leading edge with a pulse risetime of 11 nanoseconds or less.

g. Adjust - C1701, R1701, and C1703 on the Z-Axis board for the best front corner (slightly peaked).

h. Check - pulse risetime of 11 nanoseconds or less. If not, repeat step g.

i. Disconnect all test equipment except the TV Monitor. Reconnect P1637 (High Voltage Supply).

Y RAMP

EQUIPMENT REQUIRED

Test Oscilloscope

Differential Comparator Plug-in

The following equipment set-up is used for steps 28 through 34.

Refer to Fig. 8-36.

NOTE

If the R7912 is equipped with Option 13, exchange U2743 and U2755 on the Sync Generator card for the substitute program I.C.s program provided in the Cal Kit.

Equipment Set-up

a. Connect the Test Oscilloscope left vertical Channel-1 probe to R2245 on the Video Processor. Set the vertical sensitivity for 2 volts/division.

b. Install the Differential Comparator plug-in into Test Oscilloscope right vertical plug-in compartment.

c. Connect the (+) probe from the Differential Comparator to P1139 on the Scan Amp board. A convenient place to connect the probe is to the wire conductor of R1140 (the point closest to P1139). Set the input to DC and sensitivity to 500 millivolts/division.

d. Connect the (-) probe from the Differential Comparator to P1119 on Scan Amp board. A convenient place to connect the probe is to the wire conductor of R1120 (the point closest to P1119). Set the Input to Vc and the Vc range to X10.

e. Set the Test Oscilloscope main sweep rate to 5 milliseconds/division. Set the delayed sweep rate to 0.2 milliseconds/division. Externally trigger (-slope) the main sweep with the signal at TP465 on the X and Y Ramp Generator board.

f. Set the Test Oscilloscope vertical mode to Chop.

Theory: The object of this step is to adjust the amplitude of the Y Ramp to 69.5 volts ± 0.5 volt. This amplitude adjustment must be made within the unblanked region of the TV scan. The procedure is to view the Y ramp in time relation with the video blanking pulses. To obtain the accuracy needed for this amplitude measurement, the Y Ramp is expanded vertically and added to a precision DC offset. This is done with the Differential Comparator plug-in.

28. Y Ramp Gain Check/Adjust

a. Observe the Test Oscilloscope delayed sweep. Using the Delay Time Multiplier (DTM), align the end of the blanking pulse with the graticule centerline (Fig. 6-12) (about 3.20 DTM reading).

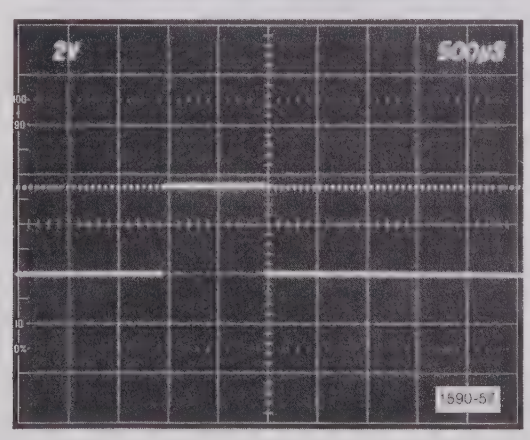

Fig. 6-12. Blanking pulse.

b. Set the offset voltage of the Differential Comparator to bring the ramp on screen (about 280 volts). The ramp will appear as a series of dashed lines. Detune R1087 (X Scan Rotation located on X and Y Ramp Generator board) to obtain a straight line ramp.

c. Set the offset voltage of the Differential Comparator so that the ramp crosses the center of the blanking pulse (Fig. 6-13).

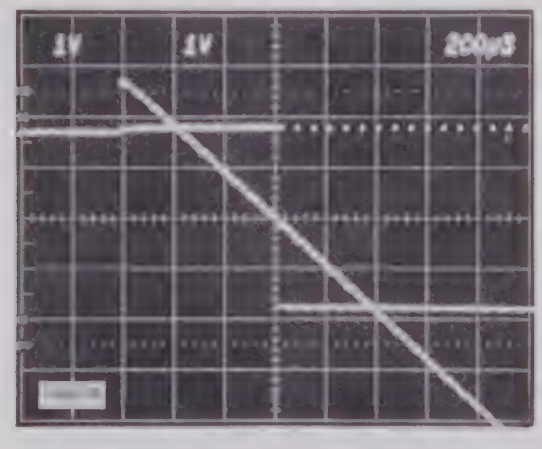

Fig. 6-13. Ramp.

d. Record the DTM reading and the Vc offset reading for future reference.

e. With the DTM, position the display so that the beginning of the blanking pulse is centered on the graticule (about 6.50 DTM reading). Record the DTM reading for future reference.

f. Subtract 69.5 volts from the Vc offset reading obtained in step d and set the Vc offset to the value calculated.

g. Check - that the ramp is within 0.35 volt of crossing the graticule centerline.

h. Adjust - R1001 (Y Ramp Gain located on X and Y Ramp Generator board) so that the ramp crosses the center of the graticule.

i. Repeat this procedure until step g is correct.

29. Y Ramp Centering Check/Adjust

a. Set the Differential Comparator (-) input to DC.

b. Determine the center of unblanking by averaging the DTM reading obtained in step 27d and the DTM reading obtained in step 27e. Set the DTM to the average value.

c. Check - that the ramp crosses the center of the Test Oscilloscope graticule $\pm$ 0.5 division.

d. Adjust - R1004 (Y Centering, located on X and Y Ramp Generator board) so that the ramp crosses the center of the graticule.

30. Y Ramp Common Mode Check/Adjust

a. Set the (-) Input of the Differential Comparator to Vc. Set Vc control to 244 volts.

b. Check - that the ramp crosses within 0.2 division of the graticule center.

c. Adjust - R1105 (Y Common Mode, located on Scan Amplifier board) so the ramp crosses the center of the Test Oscilloscope graticule.

d. Set the (-) Input of the Differential Comparator to DC and the (+) Input to Vc. Set the Vc control to 244 volts.

e. Check - that the ramp crosses within 0.2 division of graticule center.

f. Adjust - R1105 so the ramp crosses graticule center. Recheck steps a and b.

g. Disconnect the Differential Comparator probes.

h. Replace the original programmers, if Option 13 (Fig. 8-31).

VERTICAL AMPLIFIER

EQUIPMENT REQUIRED

Test Oscilloscope

Signal Standardizer

Time Base Plug-In

TV Monitor

Refer to Fig. 8-37.

31. Vertical Centering Check/Adjust

a. The Test Oscilloscope main sweep is set to 5 milliseconds/division and the delayed sweep rate is set to 0.2 milliseconds/division (from previous steps). Set the Delay Time Multiplier (DTM) to observe the center of unblanking as done in step 28b.

b. Connect the Test Oscilloscope Channel 2 vertical probe to TP2232 on Video Processor board. Set the vertical sensitivity for 500 millivolts/division. Set the Vertical Mode to Chop.

c. Install the Signal Standardizer plug-in into R7912 left plug-in compartment. Set the Test switch to Vert or Horiz Com Mode.

d. Set the R7912 INTENSITY control to obtain a visible pulse or pip displayed on the Test Oscilloscope. Detune R1087 (X Scan Rotation, located on X and Y Ramp Generator board) to obtain a sharp pulse.

e. Check that the displayed pulse aligns with the Test Oscilloscope center graticule line ± 0.5 division.

f. Adjust R712 (Vertical Amplifier Centering, located on the Vertical Amplifier board) to align the pulse with the graticule centerline.

32. Vertical Amplifier Gain Check/Adjust

a. Set the Signal Standardizer Test switch to Vert or Horiz Gain, Rep Rate 100 kilohertz.

b. Use the Signal Standardizer Position control to align the pulse with the centerline of the graticule. This pulse represents the centerline of the Signal Standardizer gain steps.

c. Set the Test Oscilloscope DTM to view the beginning and end of blanking (DTM reading about 3.10).

d. Set the Test Oscilloscope delayed sweep to 2 milliseconds/division. Check for nine (9) pulses (INTENSITY may have to be increased slightly). If nine pulses are not visible, roughly adjust R730 on the Vertical Amplifier Board. See Fig. 6-14. Return delayed sweep to 0.2 milliseconds/division.

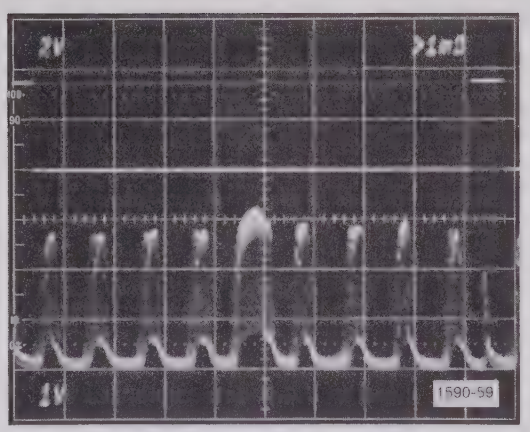

Fig. 6-14. Signal standardizer gain steps.

e. Check - that the pulse (representing the first and last of the Signal Standardizer gain steps) occurs during unblanking and is within 1 division of blanking.

f. Adjust - R730 (Vertical Gain, located on the Vertical Amplifier board) so that the pulse occurs during unblanking and is within 1 division of blanking. Vertical centering (R712) may need to be readjusted.

33. Ramp Amplitude Check/Adjust

a. Turn the GRATICULE GENERATOR control on (clockwise from the detent position).

b. Connect the Test Oscilloscope probe to TP2613 on the Graticule Generator board.

c. Set the Test Oscilloscope vertical sensitivity to 1 volt/division. Set the time base unit to obtain one staircase ramp as shown in Fig. 6-15.

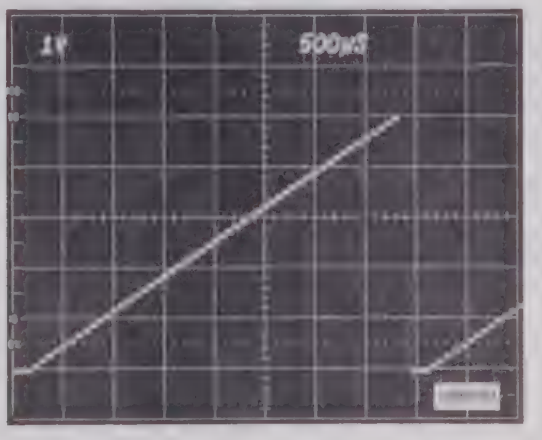

Fig. 6-15. Graticule generator ramp.

d. Check - that the amplitude of the staircase ramp is 5 volts ± 0.1 volt as measured from the top of the first step to the top of the ramp.

e. Adjust - R2513 on the Graticule Generator board for a staircase ramp of 5 volts as measured from the top of the first step to the top of the ramp.

f. Disconnect the Test Oscilloscope.

34. Electronic Graticule Vertical Position Check/Adjust

a. Connect the TV Monitor to the R7912.

b. Turn the Electronic Graticule Generator on and adjust the intensity for a visible TV Monitor Display. The Graticule Generator should be internally set for a Full display - not to the Vertex position.

c. Set the Signal Standardizer Test switch to Vert or Horiz Com Mode.

d. Check - that the Electronic Graticule center line aligns with the free-running trace.

e. Adjust - R2543 (Vertical Position, located on the Electronic Graticule board) so that the Electronic Graticule center line aligns with the free-running trace.

35. Electronic Graticule Vertical Gain Check/Adjust

a. Set the Signal Standardizer Test switch to Vert or Horiz Gain.

b. Check - that the Electronic Graticule horizontal lines align with the gain steps.

c. Adjust - R2540 (Vertical Gain, located on Electronic Graticule board) so that the Electronic Graticule horizontal lines align with the gain steps.

36. X Scan Rotation Adjust

a. Adjust - Observe the TV Monitor display and adjust R1087 on the X and Y Ramp Generator board for optimum display rotation.

b. Disconnect all test equipment. Turn the Eletronic Graticule off. Turn the INTENSITY control fully counter-clockwise (off).

X RAMP

EQUIPMENT REQUIRED

Test Oscilloscope

Differential Comparator Plug-in

The following equipment set-up is used for steps 37 through 42.

Refer to Fig. 8-38.

NOTE

If the R7912 is equipped with Option 13, switch U2743 and U2755 on the Sync Generator board (Fig. 8-31) to substitute programmers provided in Cal Kit.

Equipment Set-up

a. Connect Test Oscilloscope left vertical Channel-1 probe to R2245 on the Video Processor board. Set vertical sensitivity for 1 volt/division.

b. Install the Differential Comparator plug-in into the Test Oscilloscope right vertical plug-in compartment.

c. Connect the (+) probe from the Differential Comparator to P1169 on the Scan Amplifier board. A convenient place to connect the probe is to the wire conductor of R1170 (the point closest to P1169). Set the input to DC and the sensitivity to 500 millivolts/division.

d. Connect the (-) probe from the Differential Comparator to P1189 on the Scan Amplifier board. A convenient place to connect the probe is to the wire conductor of R1190 (the point closest to P1189). Set the (-) input to Vc, the Vc range to X10 and the Polarity to (+).

e. Set the Test Oscilloscope main sweep rate to 20 microseconds/division. Set the delayed sweep rate to 2 microseconds/division. Externally trigger the main sweep on the negative slope of the signal at TP440 on the X and Y Ramp Generator board.

f. Set the Test Oscilloscope vertical mode to Alternate.

37. X Ramp Gain Check/Adjust

a. Set the Test Oscilloscope Delay Time Multiplier (DTM) to 3.00. Use the time base position control to align the beginning of unblanking with the graticule centerline (Fig. 6-16).

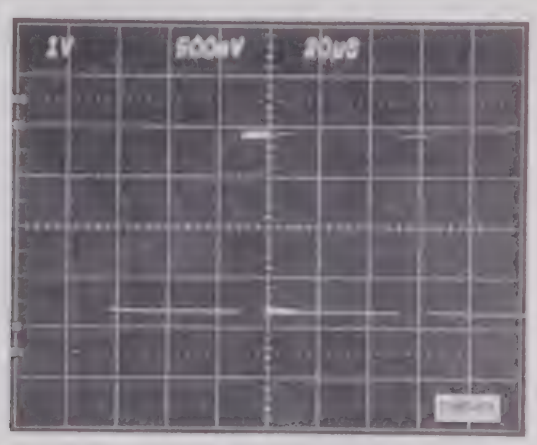

Fig. 6-16. Unblanking pulse.

b. Set the offset voltage Vc of the Differential Comparator to view the ramp (about 195 V). The ramp may appear as a series of dashed lines. Detune R1037 (Y Rotation, located on X and Y Ramp Generator board) to obtain a straight line ramp.

c. Set the horizontal amplifier to delayed sweep. Set the offset voltage of the Differential Comparator so that the ramp crosses the center of the negative transition from blanking to unblanking (Fig. 6-17).

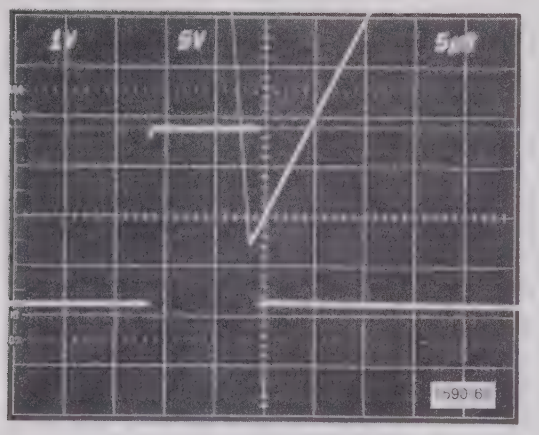

Fig. 6-17. X ramp.

d. Record the Vc reading. Add 93 volts to the Vc reading, then set the Vc control to that value.

e. Set the DTM to align the end of unblanking with the graticule centerline (DTM reading of about 5.60). Record the DTM reading for future reference.

f. Check - that the ramp crosses the center of the end of unblanking within 0.5 volt (Fig. 6-18).

g. Adjust R1051 (X Ramp Gain, on the X and Y Ramp Generator board) so that the ramp crosses the center of the blanking pulse.

h. Repeat procedure until step f is correct.

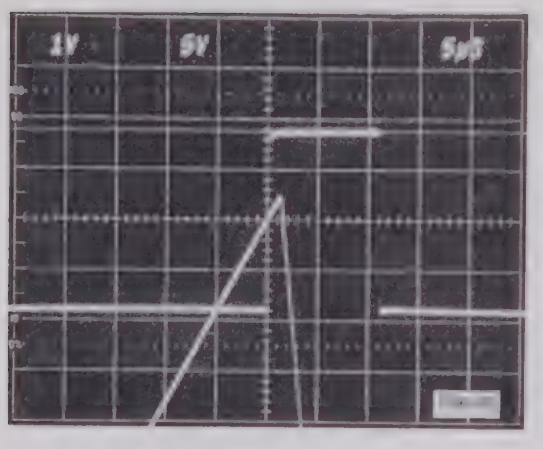

Fig. 6-14. Y ramp.

38. X Ramp Centering Check/Adjust

a. Set the Differential Comparator (-) Input to DC.

b. Determine the center of unblanking by averaging the DTM reading obtained in step 37e with the beginning DTM reading of 3.00. Set the DTM to the calculated average value.

c. Check - that the ramp crosses the center of the Test Oscilloscope graticule ± 0.5 division.

d. Adjust - R1051 (X Ramp Centering, on the X and Y Ramp Generator board) so that the ramp crosses the center of the graticule.

39. X Ramp Common Mode Check/Adjust

a. Set the (-) input of the Differential Comparator to Vc. Set the Vc control to 244 volts.

b. Check - that the ramp crosses within 0.5 division of the graticule center.

c. Adjust - R1155, X Common Mode on the Scan Amplifier board, so that the ramp crosses the center of the Test Oscilloscope graticule.

d. Set the (-) input of the Differential Comparator to DC and the (+) input to Vc. Set the Vc control to 244 volts.

e. Check - that the ramp crosses within 0.5 division of the Test Oscilloscope graticule center.

f. Adjust - R1105 (Y Common Mode) so that ramp crosses the graticule center. Recheck steps a and b.

g. Disconnect the Differential Comparator probes.

h. Replace the original programmers if the R7912 includes Option 13.

HORIZONTAL AMPLIFIER

EQUIPMENT REQUIRED

Test Oscilloscope

Signal Standardizer (067-0582-01)

Time Base Plug-in

TV Monitor

12-inch Jumper Lead

Refer to Fig. 8-39 for location of adjustments and test points used in the following procedures.

CAUTION

To prevent burning of the Scan Converter target, decrease trace Intensity before decreasing sweep speed.

40. Horizontal Centering Check/Adjust

(For instruments SN B189999-Below)

a. Set the Test Oscilloscope main sweep to 20 microseconds/division and delayed sweep rate to 2 microseconds/division. Set the Delay Time Multiplier (DTM) to observe the center of unblanking as done in step 37.

b. Connect the Test Oscilloscope Channel-2 vertical probe to TP2232 on the Video Processor board. Set the vertical sensitivity for 500 millivolts/division.

c. Install the Signal Standardizer into the R7912 right plug-in compartment. Set the Test switch to Vert or Horiz Com Mode.

d. Set the R7912 INTENSITY control to obtain a visible pulse or 'pip' displayed on the Test Oscilloscope. Detune R1037 (Y Scan Rotation located on the X and Y Ramp Generator board) to obtain a sharp pulse.

e. Check - that the largest displayed pulse aligns with the Test Oscilloscope center graticule line.

f. Adjust - R868 (Horizontal Amplifier Centering, on the Horizontal Amplifier board) to align the pulse with the graticule centerline (The ghost pulse at the center of Fig. 6-19).

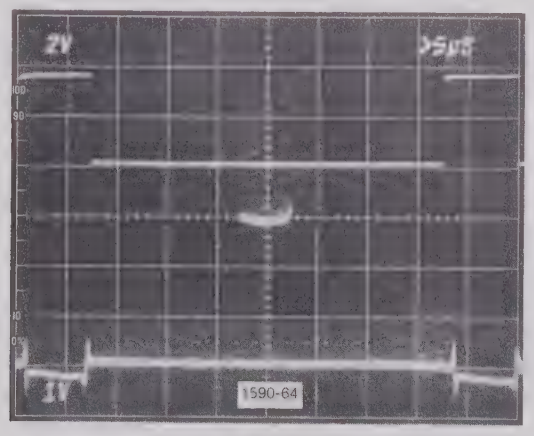

Fig. 6-19. Horizontal centering.

41. Horizontal Amplifier Gain Check/Adjust

a. Set the Signal Standardizer Test switch to Vert or Horiz Gain and Rep Rate to 100 kilohertz.

b. Use the Signal Standardizer Position control to align the pulse with the centerline of the graticule. (This pulse represents the centerline of the Signal Standardizer gain steps).

c. Set the Test Oscilloscope DTM to about 3.10 to view the beginning and end of unblanking.

d. Check - that the pulse representing the first step of the Signal Standardizer gain steps occurs after the end of blanking and is within one division of the end of blanking. Check also, that the pulse representing the last or eleventh step of the Signal Standardizer steps occurs before blanking and is within one division of blanking.

e. Adjust - The Horizontal Gain adjustment R872 (R4873 for instruments SN B190000-Above) so the first and last of the Signal Standardizer pulses occur during the unblanking period and so they are within one division of the blanking pulse. It may be necessary to readjust the Horizontal Centering adjustment R868 (R4868 for instruments SN B190000-Above) slightly (Fig. 6-20).

Refer to Fig. 8-39.

41A. Horizontal Centering Check/Adjust (For instruments SN B190000-Above)

a. Set the Test Oscilloscope main sweep to 20 microseconds/division and delayed sweep rate to 2 microseconds/division. Set the Delay Time Multiplier (DTM) to observe the center of unblanking as in step 37.

b. Connect the Test Oscilloscope Channel-2 vertical probe to TP2232 on the Video Processor board. Set the vertical sensitivity for 500 millivolts/division.

c. Install the Signal Standardizer into the R7912 right plug-in compartment. Set the Test switch to Vert or Horiz Com Mode.

d. Set the R7912 INTENSITY control to obtain a visible pulse or 'pip' displayed on the Test Oscilloscope. Detune R1037 (Y Scan Rotation, located on the X and Y Ramp Generator board) to obtain a sharp pulse.

e. Use a 12-inch jumper lead to connect TP4901 and TP4911.

f. Check - Horizontal centering of the trace is within 0.5 division of the center graticule line.

g. Adjust - The Limit Center adjustment R4925 to align the trace with the vertical graticule line.

h. Remove the jumper lead.

i. Check - That the largest displayed pulse is aligned with the center vertical graticule line.

j. Adjust - The Horizontal Center adjustment R4868 to align the trace with the center vertical graticule line. (The ghost pulse at the center of Fig. 6-19).

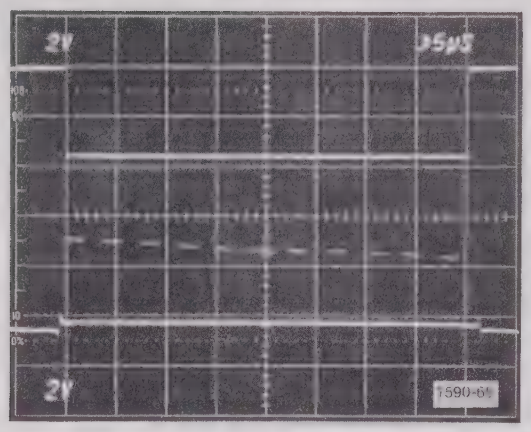

Fig. 6-20. Signal standardizer gain steps.

42. Electronic Graticule Horizontal Position Check/Adjust

Refer to Fig. 8-40.

a. Connect the TV Monitor to the R7912.

b. Turn the Electronic Graticule on. Enable the Electronic Graticule by connecting the BNC-to-multi pin connector cable supplied with the Cal Kit to the four unused pins of P2405 on the Electronic Graticule board. Align the arrow on the multi-pin-connector with the arrow marked on the circuit board. Connect the BNC end of the cable to the R7912 calibrator connector. Set the calibrator switch to the 4 volt position.

c. Set the Graticule Intensity control for a visible TV Monitor display. The Graticule Generator should be internally set for a full display.

d. Install a Time Base into the vertical compartment of the R7912.

e. Set the Signal Standardizer Test switch to Vert or Horiz Com Mode.

f. Check - that the Electronic Graticule centerline algins with the free-running trace.

g. Adjust - R2643 (Horizontal Position, on the Electronic Graticule board) so that the Electronic Graticule centerline aligns with the free-running trace.

43. Electronic Graticule Generator Gain Check/Adjust

a. Set the Signal Standardizer Test switch to Vert or Horiz Gain.

b. Check - that the Electronic Graticule lines align with the gain steps.

c. Adjust - R2640 (Horizontal Gain, on the Electronic Graticule board) so that the Electronic Graticule lines align with the gain steps.

44. Vertical Dots Check/Adjust

a. Turn the R7912 INTENSITY control fully counterclockwise.

b. Check - graticule display for a full array of vertical dots with no dots extending beyond the top or bottom horizontal graticule lines.

c. Adjust - R2425 on the Graticule Generator for a full array of vertical dots with no dots extending beyond the top or bottom horizontal graticule lines.

d. Remove the BNC to multi-pin connector cable. Remove the Signal Standardizer plug-in. Move the Time Base plug-in to the Horizontal (right) plug-in compartment. Turn the GRATICULE GENERATOR and READOUT switches off.

45. Y Scan Rotation Adjust

a. Adjust - Observe the TV Monitor display and adjust R1037 (Y Scan Rotation located on the X and Y Ramp Generator board) for optimum display rotation.

b. Disconnect all test equipment.

VERTICAL RAMP

EQUIPMENT REQUIRED

Test Oscilloscope

Differential Comparator Plug-in

46A. Vertical Ramp Step Check/Adjust

a. Install the Differential Comparator into the Test Oscilloscope vertical Compartment.

b. Set the Differential Comparator (-) Input to Vc. Set the Vc Polarity to (+) and the Vc Range to X10. Set the Vc Offset to about 280 volts.

c. Connect the Differential Comparator (+) Input to P1139 on Scan Amplifier board. A convenient place to connect the probe is to the wire conductor of R1140 (the point closest to P1139). Set the Input to DC and sensitivity for 100 millivolts/division.

d. Disconnect J2317 on the Video Processor board.

e. Set the Test Oscilloscope main sweep rate to 2 microseconds/division. Set the Delayed sweep rate to 100 nanoseconds/division.

f. Externally trigger the test Oscilloscope main sweep with the positive slope of the signal from TP465 on the X and Y Ramp Generator board.

g. Set the R7912 OPERATING MODE to DIGITAL.

h. Set the Test Oscilloscope Delay Time Multiplier to view ramp steps (Fig. 6-21). A hazy trace is acceptable.

i. Detune R1087 (X Scan Rotation, on the X and Y Ramp Generator board) for a stable display.

WARNING

Extreme caution must be used when adjusting C1127 due to the high potentials surrounding it. This adjustment can be safely made by opening the swingout front panel.

j. Check - for a step display with minimum ringing and sharp corners as shown in Fig. 6-21.

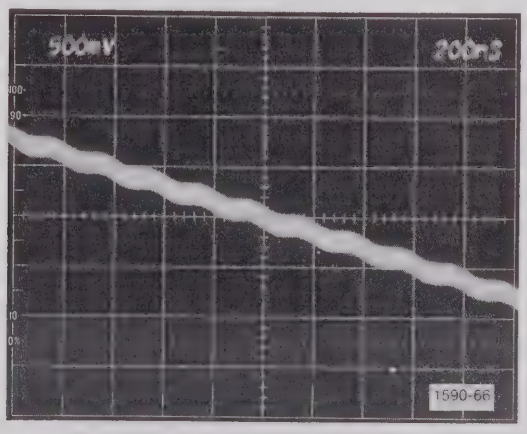

Fig. 6-21. Vertical ramp.

k. Adjust - C1018-C1029 on the X and Y Ramp Generator board, and R1127-C1127 on the Scan Amplifier board for best step with minimum ringing and sharp corners. Refer to the example shown in Fig. 6-21.

l. Readjust R1087 (X Scan Rotation) on the X and Y Ramp Generator board, if necessary, for best display.

m. Disconnect the test equipment.

VERTICAL RAMP

Refer to Fig. 8-41.

46B. Vertical Ramp Gain Check/Adjust

a. Place the R7912 on its side with both top and bottom covers removed. Set the operating Mode to Non-Store.

b. Connect a X10 probe to channel-one of the Test Oscilloscope and connect the probe to R2245 on the Video Processor board. Set the test Oscilloscope vertical amplifier to DC coupling and 1 volt/division sensitivity.

c. Set the main sweep to 5 milliseconds/division and delayed sweep to 0.2 milliseconds/division. Connect the Main Trigger In to T.P. 465 on the R7912 X-Y Ramp board using the 10X probe. Set the horizontal amplifier to AUTO, A.C., EXT., and trigger on the negative slope.

d. Set the DTM to 3.20; position the trace so that the blanking pulse from Left vertical plug-in is centered on the screen and check that the blanking pulse width is 1.36 milliseconds ± 0.063 milliseconds. If correct, then unblanking pulse should be 15.41 milliseconds ± 0.5%.

e. Set the 7A13 (+) Input to D.C., the (-) Input to Vc, the BW to Full, and the Vc to (+). Connect the negative probe to P1119 and the positive probe to P1139, both located on the Scan Amp. The easiest place to connect to these points is on the ends of R1120 and R1140 closest to the plug.

Set the Volts/division to 10 millivolts and pull the Variable for X10 Vc. Preset Vc + to about 280 V. Set the DTM back to 3.20 and set the start of unblanking to the center of the test scope graticule, using the horizontal position knob. Set the Vc (comparison voltage) so the sweep from R1140 starts at the center of the graticule and at the start of unblanking (Fig. 6-22). Adjust R1087 to obtain a sharp ramp display.

CAUTION

Always depress Vc Ref - Ident button to set plug-in to center before making measurement. Obtain Vc reading and record.

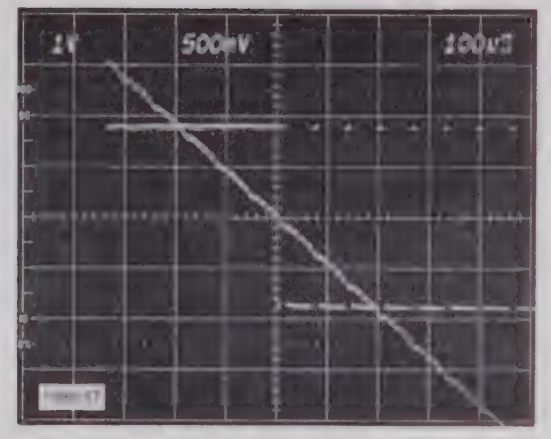

Fig. 6-23. Vertical ramp path.

Using the DTM, set the end of the string of unblanking signals to the center of the graticule. Reduce Vc so the ramp crosses the center of the last positive transition (Fig. 6-23). Check for drift with Vc Ref - Ident button and record the reading. The difference between readings should be 69.5 ± 0.5%. If not, adjust R1001. (If the reading is incorrect, take the first reading and subtract 69.5 V. Set Vc to the proper voltage and adjust R1001 to center the graticule.) To check, repeat step e.

f. To center the ramps, set both inputs of the 7A13 to D.C. and 0.2 volt/division. Determine the center of the positive unblanking pulse transition and position it to the center of the graticule with the horizontal position control. Depress the Vc-Ref Ident button and center the vertical position of the 7A13. If the sweep does not cross the center of the graticule, adjust R1004 until it does.

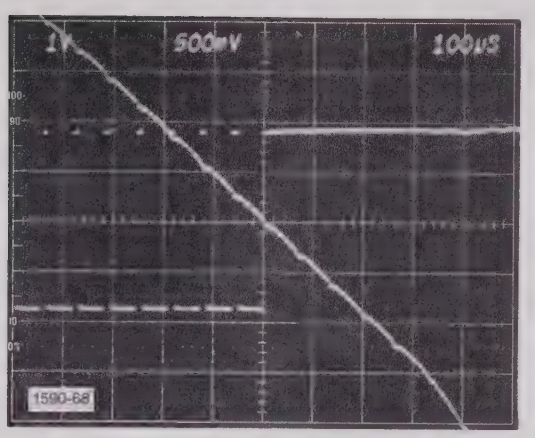

Fig. 6-23. Vertical ramp gain.

g. Remove the probes from R1120 and R1140 (connect the positive probe to TP 2232 located on the video processor, and set the 7A13 to 0.1 volt/division. Connect the negative probe to GND.

h. Install the 067-0587-01 Signal Standardizer in the R7912 Vertical plug-in compartment and set to Common mode. Set the R7912 time base to 1 millisecond/division. Adjust the test oscilloscope intensity for a good video pulse and position to the center of the test oscilloscope graticule. Switch the Signal Standardizer to Gain and adjust the position control to match the center of the previous pulse.

Adjust R1087 (X-Scan Rotation, on the X and Y Ramp Generator board) to obtain a sharp pulse.

Using the DTM, return the center of unblanking (step f) to center of graticule. Adjust R712 (Vertical Ramp Centering on the Vertical Amplifier board) so that the pulse appears at the center of graticule.

Using the DTM, observe that the first of nine lines appears at center of start of unblanking and the ninth at center of end of unblanking. If not, adjust gain (R730) of vertical amplifier. Repeat the above procedure until the correct match is achieved. R712 may need readjustment.

Refer to Fig. 8-40.

i. Turn the Readout on and turn up the Graticule intensity until a graticule is visible. With the Signal Standardizer in Common mode, adjust R2543 (Vertical position, on Graticule generator board) to match the graticule center to that of the Signal Standardizer. Set the Signal Standardizer to Gain and adjust R2540 (Vertical Gain) to match the gain of the vertical amplifier. The dots will overlay the lines.

X RAMP

EQUIPMENT REQUIRED

Test Oscilloscope

Differential Comparator Plug-in

46c. X Ramp Gain Check/Adjust

a. Set the test oscilloscope time base for a main sweep of 20 microseconds/division and a delayed sweep of 2 microseconds/division. Connect the main Trigger In to TP 440 on the R7912 X-Y Ramp Generator board with a 10X probe. Set the time base to AUTO, AC, EXT., and trigger on the negative slope. See Fig. 8-40.

b. Set the Horizontal sweep to Delayed and Delay Time Multiplier to 3.00. Position the trace so the blanking pulse from the Left vertical plug-in is centered on the screen and check that the Horizontal blanking pulse width is 11 microseconds $\pm$ 0.55 microsecond. If it is correct, the Horizontal unblanking pulse should be 52.49 microseconds long, $\pm$ 1%.

c. Set the 7A13 (+) Input to D.C., the (-) Input to Vc, the BW to Full, and the Vc to (+).Connect the negative probe to P1189 and the positive probe to P1169 on the Scan Amp board. The easiest place to connect to these points is at the ends of R1190 and R1170 nearest the plugs.

Refer to Fig. 8-39.

f. Insert the Signal Standardizer into the R7912 Horizontal Compartment and set to Common mode. Insert the time base into the vertical compartment. Triggering to P-P Auto, A.C., and Int. Set Mag. to X1. Set the Intensity for a good video pulse and position it to the center of the graticule on the test scope. Switch the Signal Standardizer to Gain and adjust the position control to match the center of the previous pulse. Adjust R1037 on the X and Y Ramp Generator to obtain a sharp pulse.

Using the DTM, return the center of unblanking (part e) to the center of the graticule. Adjust Horizontal Centering adjustment R868 (R4868 for instruments SN B190000-Above) so pulse appears at the center of the graticule. Using the DTM, observe that the first of eleven lines appears on center of the start of unblanking and the eleventh appears on center of end of unblanking (Fig. 6-26). If they do not, adjust Horizontal Amplifier Gain adjustment R872 (R4873 for instruments SN B190000-Above) until they do. Repeat the above procedure until a correct match is achieved. R868 (R4868) may need readjustment also.

Refer to Fig. 8-39.

g. Connect the 067-0710-00 cable from the calibration kit to the Graticule Generator and to the front-panel calibrator connector. Set the calibrator switch to 4 volts.

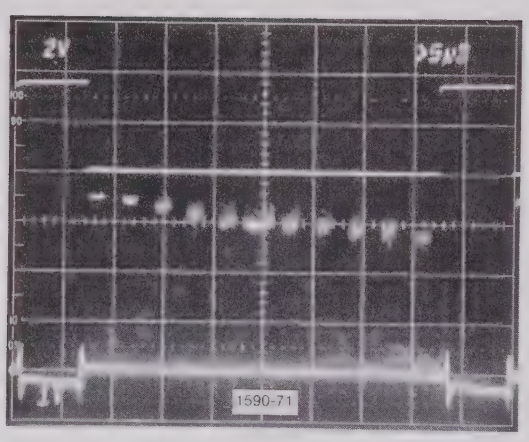

Fig. 6-26. Signal standardizer gain steps.

Turn the readout on and adjust the Graticule Intensity for a visible graticule. Set the Signal Standardizer to Common mode and adjust R2643 (Horizontal position on the Graticule Generator board) to match the graticule center to that of the Signal Standardizer.

Set the Signal Standardizer to Gain and adjust R2640 (Horizontal Gain on the Graticule Generator board) to match the gain of the horizontal amplifier. The dots will overlay the lines.

HORIZONTAL AMPLIFIER RESPONSE

EQUIPMENT REQUIRED

Signal Standardizer

Time Base

Time Mark Generator

TV Monitor

47. High Frequency Compensation Check/Adjust (For instruments SNB189999-Below)

a. Install the Signal Standardizer in the R7912 Horizontal compartment.

b. Install the Time Base in the R7912 Vertical Compartment.

c. Set the Signal Standardizer Test switch to (+) Step Response.

d. Externally trigger the Time Base with the Signal Standardizer trigger output. Set the sweep speed to 200 nanoseconds/division.

e. Check - TV Monitor display for optimum square corner and flat top. Aberrations within the first 50 nanoseconds should be within $\pm$ 0.23 division with a total peak-to-peak aberration not to exceed 0.23 division.

f. Adjust - high frequency compensation as given in Table 6-3 for optimum square leading corner and flat top with minimum aberrations.

g. Check - Repeat step e.

h. Remove the plug-ins.

TABLE 6-3

For instruments SN B189999-Below

Control	Affected Portion
R906	100 ns
R870	200 ns
C905	500 ns
C928	1 µs
C948	1 µs

Refer to Fig. 8-39.

48. Timing Accuracy Check/Adjust

a. Install the time base into the R7912 Horizontal compartment.

b. Install the Signal Standardizer into the R7912 Vertical compartment.

c. Connect the Time Mark Generator output to the Signal Standardizer Aux In connector. Set the Signal Standardizer Test switch to Aux In.

d. Connect the Time Mark Generator trigger output to the time base trigger input.

e. Set the Time Mark Generator for 2 nanosecond markers.

f. Set the time base to 2 nanoseconds/division.

g. Check - For a TV Monitor display of one marker per division $\pm$ 0.32 division.

h. Adjust - C905 (C4909 and C4919 for instruments SN B190000-Above) on the Horizontal Amplifier board for a TV Monitor display of 1 marker/division.

i. Set the time base to 0.5 nanosecond/division.

j. Check - For a TV Monitor display of 2 markers in the center eight divisions $\pm$ 0.4 division.

k. Adjust - R906 (C4874 for instruments SN B190000-Above) for a TV Monitor display of 2 markers in the center eight divisions.

Refer to Fig. 8-40.

49. X-Y Phase Shift Check

a. Install identical amplifiers (7A-series) in the R7912 Vertical and Horizontal compartments.

b. Set both amplifier units for a deflection factor of ten millivolts/division with DC coupling.

c. Connect the Lower Frequency Signal Generator to both amplifier units. Set the frequency to 35 kilohertz.

d. Obtain an Electronic Graticule display using the following procedure: Connect the BNC to multi-pin-connector cable (supplied with R7912 Calibration Kit) from the R7912 CALIBRATOR output to the four unused pins of P2405 on the Graticule Generator board. Align the arrow of the multi-pin connector with the arrow marked on the Electronic Graticule Generator circuit board. Set the R7912 CALIBRATOR push-button switch to IN 4.0 V. Set the R7912 GRATICULE control for a visible TV Monitor display.

e. Set the Low Frequency Signal Generator for a vertical and horizontal TV Monitor display of eight divisions (Fig. 6-27).

f. Check - Lissajous display for an opening at the center vertical line of 0.28 division or less (indicates 2 degrees or less phase shift.

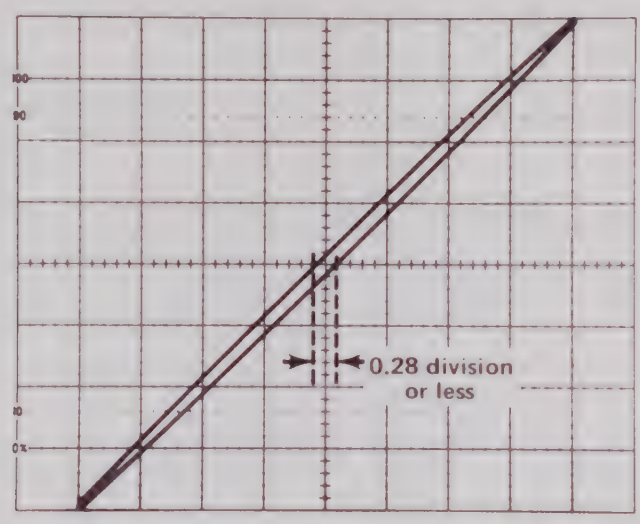

Fig. F-37. X-Y phase shift.

VERTICAL AMPLIFIER

EQUIPMENT REQUIRED

TV Monitor

High Frequency Signal Generator

Signal Standardizer

Refer to Fig. 8-37.

50. High Frequency Compensation Check/Adjust

a. Install the Signal Standardizer in the R7912 Vertical compartment and the time base in the Horizontal compartment.

b. Set the Signal Standardizer Test switch to Vert or Horiz + Step Resp. Set the Rep Rate switch to 100 hertz and adjust the Amplitude control for a six-division display.

c. Set the time base sweep rate to 1 millisecond/division.

d. Check - for optimum square corner and flat top on displayed pulse with aberrations not to exceed $\pm$ 0.1 division.

e. Adjust - R764 and R749 on the Vertical Amplifier board for a flat top within limits given in step d.

f. Set the Signal Standardizer Rep Rate switch to 1 megahertz. Set the time base sweep rate to 10 nanoseconds/division.

g. Check - for optimum square corner and flat top on displayed pulse with aberrations not to exceed ± 0.1 divisin.

h. Adjust - high frequency compensation as given in Table 6-4 for optimum square leading corner and flat top with minimum aberrations. Use a low-capacitance screwdriver to adjust the variable capacitors. Repeat the adjustments as necessary to compensate for interactions.

TABLE 6-4

Adjustment	Primary Area of Pulse Affected	Time Base Sweep Rate Setting
R758	First 100 ns	10 ns/div
R743	First 25 ns	5 ns/div
CRT leads to Termination resistor	First 5 ns	10 ns/div
C658,R658	Leading edge	2 ns/div
L667	First 3 ns	2 ns/div

51. Low-Frequency Linearity Check

a. Set the Signal Standardizer Rep Rate switch to 1 kilohertz.

b. Set the R7912 time base to 0.5 millisecond/division.

c. Turn the R7912 Graticule Generator on.

d. Set the Signal Standardizer Amplitude and Position controls for a centered, two division TV Monitor display.

e. Turn the Graticule Generator off.

f. Connect the R7912 VIDEO BINARY signal to the Test Oscilloscope vertical input. Set the vertical sensitivity to 0.5 volts/division.

g. Trigger the Test Oscilloscope with the Y Ramp Gate signal from TP425 on the X and Y Generator circuit board. Set the sweep rate to 2 milliseconds/division.

h. Observe the two pulses displayed on the Test Oscilloscope. These represent the two division display shown on the TV Monitor.

i. Set the Test Oscilloscope time base to view an expanded, delayed sweep of the two pulses. Vary the delayed sweep rate so the center-to-center distance between the two pulses is exactly eight division. (Note: Adjust the R7912 INTENSITY control for narrow pulses.)

j. Turn the Graticule Generator on.

k. Position the two division TV Monitor display to the top two graticule lines.

l. Turn the Electronic Graticule off.

m. Set the Test Oscilloscope time base delay time multiplier to again view the two pulses.

n. Check - that the center-to-center distance between the two pulses is 8 divisions $\pm$ 0.4 division.

o. Turn the Electronic Graticule on.

p. Position the two division TV Monitor display to the bottom two graticule lines.

q. Turn the Electronic Graticule off.

r. Check - that the center-to-center distance between the two pulses is eight divisions $\pm$ 0.4 division.

s. Disconnect the Test Oscilloscope. Turn the Graticule on.

52. Vertical Amplifier Bandwidth Check

a. Connect the High Frequency Signal Generator to the Signal Standardizer CW In connector.

b. Set the High Frequency Signal Generator to a reference frequency below 10 megahertz.

c. Set the Signal Standardizer Test switch to Vert or Horiz Freq Resp. Set the controls to obtain a "leveled" 6 division display. Refer to the Signal Standardizer manual for necessary information.

d. Check - that the display amplitude remains at 6 divisions -1.4 divisions while varying the High Frequency Signal Generator frequency up to 500 megahertz.

e. If the bandwidth specification is not met, repeat step 50.

53. Signal to Graticule Isolation Check

a. Set the Signal Standardizer Amplitude control to obtain an eight division display.

b. Set the GRATICULE intensity to obtain small dots.

c. Check - that the size of the graticule dots does not change more than 0.08 division while alternately disconnecting and re-connecting the High Frequency Signal Generator.

READOUT SYSTEM

EQUIPMENT REQUIRED

Time Base

TV Monitor

Vertical Amplifier

Refer to Fig. 8-42.

54. Vertical Separation and Centering Check/Adjust

a. Install the vertical amplifier in the R7912 Vertical compartment.

b. Remove Q3416 (on Readout board) from its socket. It will be necessary to raise the Readout Circuit board out of the instrument.

c. Turn the R7912 READOUT control clockwise to obtain a visible display.

d. Check - TV Monitor display for two rows of characters, 40 characters per row with no overlap. The two rows of characters should be located in the middle of the top and bottom divisions of the graticule.

e. Adjust - R3490 (Vertical separation) and R707 (Vertical centering) on the vertical amplifier board to position the two rows of readout characters to the middle of the top and bottom divisions of the graticule.

f. Turn the R7912 POWER switch OFF. Replace Q3416 and turn the POWER switch ON.

55. Character Scan Check/Adjust

a. Set the vertical amplifier plug-in unit vertical sensitivity to 50 millivolt/division.

b. Check - displayed characters for completeness without "overscanning" (overscanning causes a bright dot where traces overlap).

c. Adjust - R3437 for displayed characters that are complete and not "overscanned". The m and the 5 will show the most change.

56. Column and Row Match Check/Adjust

a. Press and hold the vertical amplifier Identify buttons.

b. Check - Readout display for correct indication of "IDENTIFY". If the readout display blinks or is incorrect, adjustment is required.

c. Adjust - R3422 and R3407 for correct readout of "IDENTIFY". Set these adjustments to the center of the adjustment range.

d. Release the vertical amplifier Identify buttons.

e. Check - the readout correctness for several settings of the time base and vertical amplifier.

f. Replace the Readout board in R7912.

57. Readout to ASCII Converter (Option 20) Check/Adjust

Refer to Fig. 8-42.

a. Locate the Readout to ASCII Converter board mounted on a subchassis marked 441-1165-00.

b. Remove the four screws holding the subchassis.

c. Raise the subchassis almost out of the instrument and temporarily install a screw through the top hole in the right side of the R7912 to hold the chassis in the raised position.

d. Connect the output of the Pulse Generator to the channel one input of the test oscilloscope with a 75 ohm shielded BNC cable terminated with 75 ohms. Adjust the Pulse Generator to produce the waveform shown in Fig. 6-28.

e. Disconnect the cable from the Test Oscilloscope.

f. Unplug P4460 from the top of the Readout to ASCII Converter board.

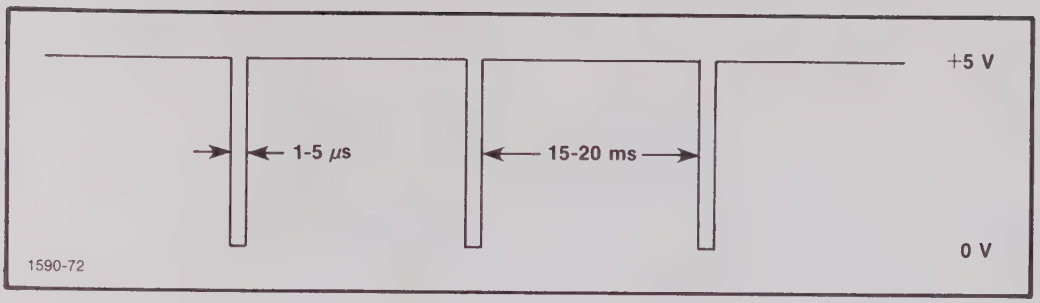

Fig. 6-28. Pulse generator output.

g. Connect the terminated output of the Pulse Generator to pin 2 of the exposed board-mounted pins (Pin 1 has a small triangular locator mark near it).

h. Externally trigger the Test Oscilloscope time base with the Pulse Generator trigger output.

i. Set the Test Oscilloscope main sweep rate to 2 milliseconds per division and the delayed sweep rate to 5 microseconds per division. Set the delayed sweep delay-time multiplier to 0.00.

j. Connect the Test Oscilloscope channel-1 probe to pin 15 of U4469. Set the channel-1 vertical sensitivity to 10 volts per division.

k. Connect the Test Oscilloscope channel-2 probe to pin 12 of U4469. Set the channel-2 vertical sensitivity to 2 volts per division.

l. Set the Test Oscilloscope vertical display mode to ADD.

m. Install the Amplifier Plug-in into the R7912 left plug-in compartment. Set the volts/division switch to 1 V. Set the variable control to the uncalibrated position.

n. Set the R7912 POWER switch to the ON position.

o. Rotate the Test Oscilloscope delayed time multiplier to observe the first group of pulses (delayed time multiplier reading of approximately 1.00). The waveform should be similar to Fig. 6-29.

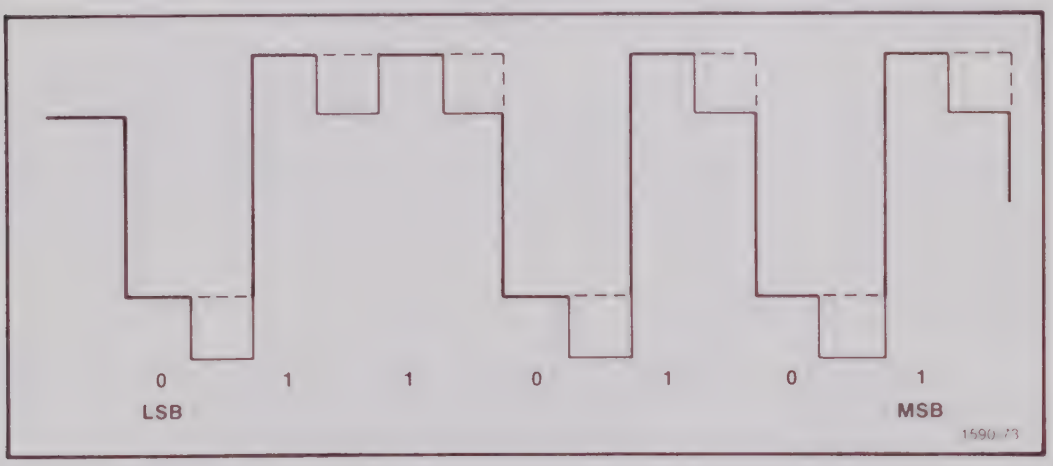

Fig. 6-29. ASCII code for V.

p. Adjust - R4422 Row Match for a non-stable display and note the position. Rotate the control in the opposite direction for a non-stable display and note the position. Set the control midway between these two positions.

NOTE

If a non-stable display cannot be achieved, set the control to the physical center of its range.

q. Rotate the Test Oscilloscope delay time multiplier to view the third group of pulses (delay time multiplier reading of approximately 2.10). The waveform should be similar to Fig. 6-30.

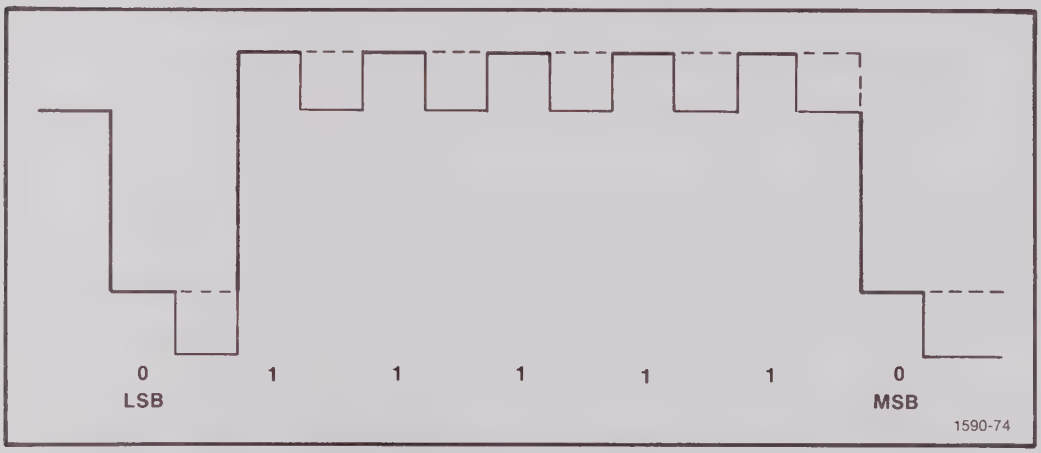

Fig. 6-30. ASCII code for a blank.

r. Adjust - R4407 Column Match for a non-stable display and note the position. Rotate the control in the opposite direction for a non-stable display and note the position. Set the control midway between these two positions.

NOTE

If a non-stable display cannot be achieved, set the control to the physical center of its range.

s. Disconnect all test equipment.

DIGITAL

EQUIPMENT REQUIRED

R7912 Calibration Aid

Time Base Plug-in

TV Monitor

Amplifier Plug-in

Memory Display Unit

X-Y Display Monitor

58. Horizontal Data Resloution Check/Adjust

a. Connect the R7912 Calibration Aid Probe Power cable to the R7912 PROBE POWER connector. Connect the R7912 Calibration Aid Calibrator In to the R7912 CALIBRATOR.

b. Set the R7912 Calibration Aid Mode switch to Preamp. Set the Vertical Delay - Out.

c. Externally trigger the R7912 sweep with the Calibration aid Trigger Output. Set the sweep rate to 50 nanoseconds/division.

d. Connect the R7912 Calibration Aid Vertical Delay Out to the R7912 vertical amplifier plug-in. Set the sensitivity for 50 millivolts/division.

e. Position the TV Monitor display to view the rising edge of a pulse. Set the INTENSITY control for a slightly blooming trace.

f. Connect the Memory Display Unit and the X-Y Storage Monitor to the R7912.

g. Digitize and display the waveform. Check that a clean double line trace is digitized. If not, readjust the INTENSITY until a clean double line trace is digitized.

h. Set the R7912 Calibration Aid to Vertical Delay In. Digitize and view the waveform. Do not erase the previously stored waveform.

i. Check - for two completely separate and distinct waveforms. Refer to Fig. 6-31.

j. Adjust - Repeat step 26 Focus Adjust, then repeat procedure. Disconnect the Calibration Aid.

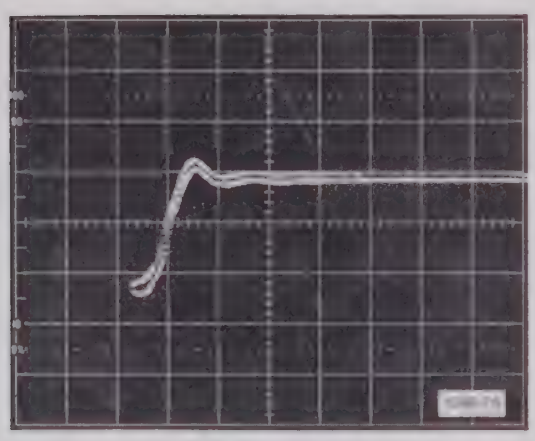

Fig. 6-31. Horizontal resolution.

59. Vertical Data Resolution Check/Adjust

a. Connect the R7912 CALIBRATOR to the R7912 amplifier plug-in via a X10 attenuator. Set the Calibrator to 4 volts IN. Set the Vertical Sensitivity to 10 millivolts/division.

b. Externally trigger the R7912 time base with the CALIBRATOR signal. This requires a BNC "T" connector. Set the sweep rate to 500 nanoseconds/division.

c. Using the amplifier Variable Volts/division control, set the TV Monitor display for five vertical divisions of deflection (use Electronic Graticule for reference).

d. Set the amplifier plug-in sensitivity to 2 volts per division. Do not move the variable control

e. Check - Digitize and display the waveform and Check for discrete level changes (a square wave display). The small level changes represent a vertical resolution of 320 lines.

f. Adjust - repeat step 26 then repeat procedure.

60. Writing Rate Check

a. Connect a 500 megahertz sine-wave from the High-frequency Signal Generator to the R7912 amplifier plug-in (7A19 or equivalent).

b. Set the Signal Generator and R7912 amplitude controls to display an eight division display.

c. Set the R7912 sweep rate to 2 nanoseconds/division. Set the R7912 sweep mode to Single Sweep.

d. Turn the R7912 INTENSITY control fully clockwise.

CAUTION

Do not attempt to operate the R7912 in Repetitive-Sweep mode while the Intensity is at maximum. Serious Scan Converter target burns may result.

e. Digitize the waveform by pressing the Single-Sweep Reset button.

f. Check - that the entire sine-wave display is digitized. If not, repeat step 26.

g. Turn the INTENSITY control fully counterclockwise (OFF).

h. Disconnect all test equipment.

This completes the calibration procedure for the R7912. Reassemble the instrument, making certain that all connectors are secure and all plug-in cards are properly seated.

@

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
00779	AMP, INC.	P. O. BOX 3608	HARRISBURG, PA 17105
00853	SANGAMO ELECTRIC CO., S. CAROLINA DIV.	P. O. BOX 128	PICKENS, SC 29671
01002	GENERAL ELECTRIC CO., INDUSTRIAL AND POWER CAPACITOR PRODUCTS DEPT.	JOHN ST.	HUDSON FALLS, NY 12839
01121	ALLEN-BRADLEY CO.	1201 2ND ST. SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P. O. BOX 5012	DALLAS, TX 75222
02660	BUNKER RAMO CORP., CONNECTOR DIVISION	2801 S 25TH AVENUE	BROADVIEW, IL 60153
02735	RCA CORP., SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
03508	GENERAL ELECTRIC CO., SEMI-CONDUCTOR PRODUCTS DEPT.	ELECTRONICS PARK	SYRACUSE, NY 13201
03888	KDI PYROFILM CORP.	60 S. JEFFERSON RD.	WHIPPANY, NJ 07981
04222	AVX CERAMICS., DIVISION OF AVX CORP.	P.O. BOX 867, 19TH AVE. SOUTH	MURTLE BEACH, SC 29577
04713	MOTOROLA, INC., SEMICONDUCTOR PRODUCTS DIV.	5005 E. MCDOWELL RD.	PHOENIX, AZ 85036
05245	CORCCM INC.	2635 N KILDARE AVENUE	CHICAGO, IL 60639
05397	UNION CARBIDE CORP., MATERIALS SYSTEMS DIVISION	11901 MADISON AVE.	CLEVELAND, OH 44101
05574	VIKING INDUSTRIES, INC.	21001 NORDOFF STREET	CHATSWORTH, CA 19311
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS ST.	MOUNTAIN VIEW, CA 94042
07716	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, BURLINGTON DIV.	2850 MT. PLEASANT	BURLINGTON, IA 52601
07910	TELEDYNE SEMICONDUCTOR	12515 CHADRON AVE.	HAWTHORNE, CA 90250
08806	GENERAL ELECTRIC CO., MINIATURE LAMP PRODUCTS DEPT.	NELA PK.	CLEVELAND, OH 44112
09023	CORNELL-DUBILIER ELECTRONIC DIVISION FEDERAL PACIFIC ELECTRIC CO.	2652 DALRYMPLE ST.	SANFORD, NC 27330
12040	NATIONAL SEMICONDUCTOR CORP.	P.O. BOX 443, COMMERCE DRIVE	DANBURY, CT 06810
12617	HAMLIN, INC.	GROVE & LAKE STS.	LAKE MILLS, WI 53551
12697	CLAROSTAT MFG. CO., INC.	LOWER WASHINGTON ST.	DOVER, NH 03820
12954	SIEMENS CORP, COMPONENTS GROUP	8700 E THOMAS RD, P.O. BOX 1390	SCOTTSDALE, AZ 85252
12969	UNITRODE CORP.	580 PLEASANT ST.	WATERTOWN, MA 02172
14099	SEMTECH CORP.	652 MITCHELL ROAD	NEWBURY PARK, CA 91320
14298	AMERICAN COMPONENTS, INC., AN INSILCO CO.	8TH AVE. AT HARRY ST.	CONSHOHOCKEN, PA 19428
14752	ELECTRO CUBE INC.	1710 S. DEL MAR AVE.	SAN GABRIEL, CA 91776
15454	RODAN INDUSTRIES, INC.	2905 BLUE STAR ST.	ANAHEIM, CA 92806
15818	TELEDYNE SEMICONDUCTOR	1300 TERRA BELLA AVE.	MOUNTAIN VIEW, CA 94043
17856	SILICONIX, INC.	2201 LAURELWOOD RD.	SANTA CLARA, CA 95054
19396	ILLINOIS TOOL WORKS, INC., PAKTRON DIV.	900 FOLLIN LANE, SE	VIENNA, VA 22180
21845	SOLITRON DEVICES, INC., TRANSISTOR DIV.	1177 BLUE HERON BLVD.	RIVIERA BEACH, FL 33404
22229	SOLITRON DEVICES, INC., DIODES, INTEGRATED CIRCUITS AND CMOS	8808 BALBOA AVE.	SAN DIEGO, CA 92123
24931	SPECIALTY CONNECTOR CO., INC.	3560 MADISON AVE.	INDIANAPOLIS, IN 46227
25088	SIEMENS CORP.	186 WOOD AVE. S	ISELIN, NJ 08830
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SAN YSIDRO WAY	SANTA CLARA, CA 95051
28480	HEWLETT-PACKARD CO., CORPORATE HQ.	1501 PAGE MILL RD.	PALO ALTO, CA 94304
34335	ADVANCED MICRO DEVICES	901 THOMPSON PL.	SUNNYVALE, CA 94086
34649	INTEL CORP.	3065 BOWERS AVE.	SANTA CLARA, CA 95051
50558	ELECTRONIC CONCEPTS, INC.	526 INDUSTRIAL WAY WEST	EATONTOWN, NJ 07724
51406	MURATA CORP. OF AMERICA	1 WESTCHESTER PLAZA	ELMSFORD, NY 10523
56289	SPRAGUE ELECTRIC CO.		NORTH ADAMS, MA 01247
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
71468	ITT CANNON ELECTRIC	666 E. DYER RD.	SANTA ANA, CA 92702
72136	ELECTRO MOTIVE CORP., SUB OF INTERNATIONAL ELECTRONICS CORP.	SOUTH PARK AND JOHN STREETS	WILLIMANTIC, CT 06226
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
74970	JOHNSON, E. F., CO.	299 10TH AVE. S. W.	WASECA, MN 56093
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108

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76493	BELL INDUSTRIES, INC., MILLER, J. W., DIV.	P O BOX 5825, 19070 REYES AVE.	COMPTON, CA 90224
79727	C-W INDUSTRIES	550 DAVISVILLE RD., P O BOX 96	WARMINISTER, PA 18974
80009	TEKTRONIX, INC.	P. O. BOX 500	BEAVERTON, OR 97005
80294	BOURNS, INC., INSTRUMENT DIV.	6135 MAGNOLIA AVE.	RIVERSIDE, CA 92506
80740	BECKMAN INSTRUMENTS, INC.	2500 HARBOR BLVD.	FULLERTON, CA 92634
81439	THERM-O-DISC, INC.	1320 S MAIN ST., P O BOX 1538	MANSFIELD, OH 44907
81483	INTERNATIONAL RECTIFIER CORP.	9220 SUNSET BLVD.	LOS ANGELES, CA 90069
82389	SWITCHCRAFT, INC.	5555 N. ELSTON AVE.	CHICAGO, IL 60630
83003	VARO, INC.	P O BOX 411, 2203 WALNUT ST.	GARLAND, TX 75040
86684	RCA CORP., ELECTRONIC COMPONENTS	415 S. 5TH ST.	HARRISON, NJ 07029
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY CO., INC.	3029 E. WASHINGTON ST.	INDIANAPOLIS, IN 46206
91418	RADIO MATERIALS CO., DIVISION OF P.R. MALLORY AND CO., INC.	4242 W BRYN MAWR	CHICAGO, IL 60646
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NB 68601
93958	REPUBLIC ELECTRONICS CORP.	176 E. 7TH ST.	PATERSON, NJ 07524
95275	VITRAMON, INC.	BOX 544	BRIDGEPORT, CT 06601
99942	CENTRALAB SEMICONDUCTOR, CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	4501 N. ARDEN DR.	EL MONTE, CA 91734

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-2484-00			CKT BOARD ASSY:MAIN INTERFACE	80009	670-2484-00
A2	670-2553-00	B010100	B089999	CKT BOARD ASSY:TRIGGER FOLLOWER	80009	670-2553-00
A2	670-1698-02	B090000		CKT BOARD ASSY:TRIGGER FOLLOWER	80009	670-1698-02
A3	670-2718-00	B010100	B010101	CKT BOARD ASSY:CALIBRATOR	80009	670-2718-00
A3	670-3246-00	B010102		CKT BOARD ASSY:CALIBRATOR	80009	670-3246-00
A4	670-2479-00			CKT BOARD ASSY:MODE SWITCH	80009	670-2479-00
A5	670-1630-01	B010100	B089999	CKT BOARD ASSY:VERTICAL AMPLIFIER	80009	670-1630-01
A5	670-1630-02	B090000		CKT BOARD ASSY:VERTICAL AMPLIFIER	80009	670-1630-02
A6	670-3206-00			CKT BOARD ASSY:VERTICAL CONNECT	80009	670-3206-00
A7	670-2526-00			CKT BOARD ASSY:DELAY LINE TERMINATION	80009	670-2526-00
A8	670-1625-01	B010100	B120429	CKT BOARD ASSY:VERTICAL INTERFACE	80009	670-1625-01
A8	670-1625-02	B120430	B139999	CKT BOARD ASSY:VERTICAL INTERFACE	80009	670-1625-02
A8	670-1625-03	B140000	B169999	CKT BOARD ASSY:VERTICAL INTERFACE	80009	670-1625-03
A8	670-1625-05	B170000		CKT BOARD ASSY:VERTICAL INTERFACE	80009	670-1625-05
A9	670-2532-01			CKT BOARD ASSY:HORIZONTAL AMPLIFER	80009	670-2532-01
A10	670-2485-00			CKT BOARD ASSY:X AND Y RAMP GENERATOR	80009	670-2485-00
A11	670-2466-00			CKT BOARD ASSY:SCAN AMPLIFIERS	80009	670-2466-00
A12	670-2690-00			CKT BOARD ASSY:READ GUN CATHODE REGULATOR	80009	670-2690-00
A13	670-2486-00			CKT BOARD ASSY:READ GUN SUPPLY	80009	670-2486-00
A14	670-2490-00			CKT BOARD ASSY:VIDEO PREAMPLIFER	80009	670-2490-00
A16	670-2482-00	B010100	B090341	CKT BOARD ASSY:VIDEO PROCESSOR	80009	670-2482-00
A16	670-2482-01	B090342		CKT BOARD ASSY:VIDEO PROCESSOR	80009	670-2482-01
A17	670-2825-00	B010100	B129999	CKT BOARD ASSY:GRATICULE GENERATOR	80009	670-2825-00
A17	670-2825-01	B130000		CKT BOARD ASSY:GRATICULE GENERATOP	80009	670-2825-01
A18	670-2493-00	B010100	B090341	CKT BOARD ASSY:SYNC GENERATOR	80009	670-2493-00
A18	670-2493-01	B090342		CKT BOARD ASSY:SYNC GENERATOR	80009	670-2493-01
A19	670-2494-00	B010100	B019999	CKT CARD ASSY:ADDRESS COUNTER	80009	670-2494-00
A19	670-2494-01	B020000		CKT CARD ASSY:ADDRESS COUNTER	80009	670-2494-01
A20	670-2480-00	B010100	B019999	CKT BOARD ASSY:MEMCRY	80009	670-2480-00
A20	670-2480-01	B020000	B129999	CKT BOARD ASSY:MEMORY	80009	670-2480-01
A20	670-2480-02	B130000		CKT BOARD ASSY:MEMORY	80009	670-2480-02
A21	670-2495-00	B010100	B180737	CKT BOARD ASSY:DATA INTERCONNECT	80009	670-2495-00
A21	670-2495-01	B180738		CKT BOARD ASSY:DATA INTERCONNECT	80009	670-2495-01
A22	670-2731-00			CKT BOARD ASSY:+365 AND +4.9 V REGULATOR	80009	670-2731-00
A23	670-2540-01			CKT BOARD ASSY::LOW VOLTAGE REGULATOR	80009	670-2540-01
A24	670-1610-02	B010100	B030211	CKT BOARD ASSY:LOW VOLTAGE POWER INVERTER	80009	670-1610-02
A24	670-1610-04	B030212		CKT BOARD ASSY:LOW VOLTAGE POWER INVERTER	80009	670-1610-04
A25	670-2483-00			CKT BOARD ASSY:HIGH VOLTAGE OSCILLATOR	80009	670-2483-00
A26	670-2730-00	B010100	B030211	CKT BOARD ASSY:CAP RECTIFIER	80009	670-2730-00
A26	670-2730-01	B030212		CKT BOARD ASSY:CAP RECTIFIER	80009	670-2730-01
A27	119-0452-00	B010100	B119999	CKT BOARD ASSY:POTTED HIGH VOLTAGE MULTIPLIER	80009	119-0452-00
A27	119-0452-01	B120000	B180758	CKT BOARD ASSY:POTTED HIGH VOLTAGE MULTIPLIER	80009	119-0452-01
A27	119-0452-02	B180759		CKT BOARD ASSY:POTTED HIGH VOLTAGE MULTIPLIER	80009	119-0452-02
A28	670-2492-00			CKT BOARD ASSY:Z AXIS	80009	670-2492-00
A29	670-1885-01			CKT BOARD ASSY:READOUT	80009	670-1885-01
A30	670-2488-00			CKT BOARD ASSY:POWER DISTRIBUTION	80009	670-2488-00
A31	670-3079-00			CKT BOARD ASSY:DUMMY READOUT	80009	670-3079-00
A32	670-3072-00	B010100	B010111X	CKT BOARD ASSY:INTERFACE BYPASS	80009	670-3072-00
A33	670-2829-00			CKT BOARD ASSY:MEMORY BYPASS	80009	670-2829-00
A35	670-3180-00	XB010112	B010141X	CKT BOARD ASSY:BUFFER	80009	670-3180-00
A36	670-3183-00			CKT BOARD ASSY:READOUT TO ASC11 CONVERTER	80009	670-3183-00
A37	670-3851-00	XB090000		CKT BOARD ASSY:TRIG BUFFER AMPLIFIER	80009	670-3851-00
A38	670-3256-00			CKT BOARD ASSY:DUMMY GRATICULE GENERATOR	80009	670-3256-00
B1203	119-0215-04			FAN,AXIAL:	80009	119-0215-04
B1204[1]	119-0581-00			FAN,AXIAL:115V,400HZ,41W,122CFM	80009	119-0581-00

[1]Option 5 only.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C3	290-0270-00	B010100	B050299	CAP.,FXD,ELCTLT:8.2UF,20%,60V	56289	150D825X0060R2
C3	290-0716-00	B050300		CAP.,FXD,ELCTLT:8.2UF,20%,75V	05397	T11C825M075AS
C3	290-0716-00	B050300		CAP.,FXD,ELCTLT:8.2UF,20%,75V	05397	T11C825M075AS
C4	290-0529-00			CAP.,FXD,ELCTLT:47UF,20%,20V	56289	196D476X0020LA3
C5	290-0529-00			CAP.,FXD,ELCTLT:47UF,20%,20V	56289	196D476X0020LA3
C6	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	56289	196D107X0020MA3
C7	290-0270-00	B010100	B050299	CAP.,FXD,ELCTLT:8.2UF,20%,60V	56289	150D825X0060R2
C7	290-0716-00	B050300		CAP.,FXD,ELCTLT:8.2UF,20%,75V	05397	T11C825M075AS
C14	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C15	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C17	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C23	283-0670-00			CAP.,FXD,MICA D:375PF,1%,500V	00853	D155F3750F0
C27	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C30	281-0603-00			CAP.,FXD,CER DI:39PF,5%,500V	72982	308-000C0G0390J
C32	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C40	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C51	281-0547-00			CAP.,FXD,CER DI:2.7PF,10%,500V	72982	301-000C0J0279C
C53	281-0503-00			CAP.,FXD,CER DI:8PF,+/-0.5PF,500V	72982	301-000C0H0809D
C55	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C59	281-0503-00			CAP.,FXD,CER DI:8PF,+/-0.5PF,500V	72982	301-000C0H0809D
C60	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C62	281-0547-00			CAP.,FXD,CER DI:2.7PF,10%,500V	72982	301-000C0J0279C
C96	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C128	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C132	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C133	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C148	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025NLF
C152	285-0702-00			CAP.,FXD,PLSTC:0.033UF,5%,100V	56289	410P111
C158	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C160	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C163	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C203	283-0000-00	B010100	B010101	CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C203	283-0204-00	B010102		CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N058651103M
C205	281-0613-00	B010100	B010101X	CAP.,FXD,CER DI:10PF,+/-1PF,200V	72982	374-001C0G0100F
C209	285-0905-00	XB010102		CAP.,FXD,PLSTC:0.33UF,5%,50V	56289	LP66A1A334J002
C210	283-0752-00	XB010102		CAP.,FXD,MICA D:345PF,1%,500V	00853	D15ED50F500
C211	283-0177-00	XB010102		CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C215	283-0725-00	B010100	B010101X	CAP.,FXD,MICA D:214PF,1%,500V	00853	D15-5E2140F0
C216	290-0269-00	B010100	B010101	CAP.,FXD,ELCTLT:0.22UF,5%,35V	56289	1620224X5035BC2
C216	281-0523-00	B010102		CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C219	283-0024-00	XB010102		CAP.,FXD,CER DI:0.1UF,+80-20%,30V	72982	814N039-E-104Z
C223	283-0181-00	XB010102		CAP.,FXD,CER DI:1.8PF,10%,100V	72982	8101A108C0K189B
C224	281-0651-00	B010100	B010101X	CAP.,FXD,CER DI:47PF,5%,200V	72982	374-001T2H0470J
C225	283-0024-00	XB010102		CAP.,FXD,CER DI:0.1UF,+80-20%,30V	72982	814N039-E-104Z
C227	283-0177-00	XB010102		CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C228	281-0722-00	B010100	B010101X	CAP.,FXD,CER DI:7.5PF,+/-1PF,500V	72982	374005C0G759B
C231	283-0167-00	XB010102		CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N147W5R104K
C235	283-0204-00	XB010102		CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N058651103M
C241	283-0178-00	B010100	B010101	CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C241	281-0186-00	B010102	B130499	CAP.,VAR,PLSTC:1.1-3.5PF,100V	74970	273-0005-005
C241	281-0218-00	B130500		CAP.,VAR,CER DI:1-5PF,+2-2.5%,100V	72982	513-001A-1.0-5
C243	283-0000-00	B010100	B010101X	CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C244	290-0574-00	B010100	B010101X	CAP.,FXD,ELCTLT:47UF,10%,20V	56289	196D476X9020

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C246	283-0178-00	B010100	B010101	CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C246	283-0185-00	B010102		CAP.,FXD,CER DI:2.5PF,5%,50V	72982	8101A058C0K259B
C247	283-0065-00	B010100	B010101X	CAP.,FXD,CER DI:0.001UF,5%,100V	72982	805-505B102J
C248	283-0204-00	XB010102		CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N058651103M
C265	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C266	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C270	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C274	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C276	281-0546-00			CAP.,FXD,CER DI:330PF,10%,500V	04222	7001-1380
C278	281-0501-00			CAP.,FXD,CER DI:4.7PF,+/-1PF,500V	72982	301-000S2H0479F
C285	290-0525-00			CAP.,FXD,ELCTLT:4.7UF,20%,50V	56289	196D475X0050KA1
C287	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C293	281-0536-00	B010100	B010111	CAP.,FXD,CER DI:1000PF,10%,500V	72982	301055X5P102K
C293	281-0518-00	B010112		CAP.,FXD,CER DI:47PF,+/-9.4PF,500V	72982	301-000U2J0470M
C304	283-0003-00	B010100	B010111X	CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C307	283-0003-00	B010100	B010111X	CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C309	281-0549-00			CAP.,FXD,CER DI:68PF,10%,500V	72982	301-000U2J0680K
C310	283-0212-00	B010100	B039999	CAP.,FXD,CER DI:2UF,20%,50V	72982	8141050651205M
C310	283-0177-00	B040000		CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C311	281-0536-00			CAP.,FXD,CER DI:1000PF,10%,500V	72982	301055X5P102K
C314	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C320	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C322	283-0616-00			CAP.,FXD,MICA D:75PF,5%,500V	00853	D155E750J0
C328	290-0534-00			CAP.,FXD,ELCTLT:1UF,35V	04222	CM20D820J
C330	290-0534-00			CAP.,FXD,ELCTLT:1UF,35V	04222	CM20D820J
C331	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C336	281-0543-00			CAP.,FXD,CER DI:270PF,10%,500V	72982	301055X5P271K
C339	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C341	281-0543-00			CAP.,FXD,CER DI:270PF,10%,500V	72982	301055X5P271K
C345	283-0191-00			CAP.,FXD,CER DI:0.022UF,20%,50V	72982	8121N063651223M
C364	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C365	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C366	281-0542-00			CAP.,FXD,CER DI:18PF,10%,500V	72982	301-002C0G0180K
C368	285-1062-00			CAP.,FXD,PLSTC:0.005UF,0.1%,200V	19396	70-27948
C397	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C417	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C419	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C424	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C435	290-0305-01			CAP.,FXD,ELCTLT:3UF,10%,150V	56289	109D305X9150C2
C436	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C437	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C438	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C439	290-0305-01			CAP.,FXD,ELCTLT:3UF,10%,150V	56289	109D305X9150C2
C444	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C447	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C449	281-0605-00			CAP.,FXD,CER DI:200PF,10%,500V	04222	7001-1375
C450	283-0212-00			CAP.,FXD,CER DI:2UF,20%,50V	72982	8141050651205M
C451	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C452	281-0536-00			CAP.,FXD,CER DI:1000PF,10%,500V	72982	301055X5P102K
C458	290-0560-00	B010100	B010111	CAP.,FXD,ELCTLT:47UF,20%,25V	90201	TDC476M025WLG
C458	283-0111-00	B010112		CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C465	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C466	283-0599-00	B010100	B010116	CAP.,FXD,MICA D:98PF,5%,500V	00853	D105E980J0

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C466	283-0631-00	B010117		CAP.,FXD,MICA D:95PF,1%,100V	00853	D151E950F0
C471	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C475	281-0543-00			CAP.,FXD,CER DI:270PF,10%,500V	72982	301055X5P271K
C489	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C499	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C503	281-0512-00			CAP.,FXD,CER DI:27PF,+/-2.7PF,500V	72982	308-000C0G0270K
C508	285-1062-00			CAP.,FXD,PLSTC:0.005UF,0.1%,200V	19396	70-27948
C546	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C569	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C574	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C589	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C590	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N058651103M
C591	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N058651103M
C592	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C594	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C595	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N058651103M
C598	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N058651103M
C599	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C603	283-0160-00	B010100	B139999X	CAP.,FXD,CER DI:1.5PF,(NOM VALUE),SEL	72982	8101A058C0K159B
C606	283-0160-00	B010100	B139999X	CAP.,FXD,CER DI:1.5PF,(NOM VALUE),SEL	72982	8101A058C0K159B
C609	283-0160-00	B010100	B139999X	CAP.,FXD,CER DI:1.5PF,(NOM VALUE),SEL	72982	8101A058C0K159B
C612	283-0160-00	B010100	B139999X	CAP.,FXD,CER DI:1.5PF,(NOM VALUE),SEL	72982	8101A058C0K159B
C620	283-0203-00	B010100	B139999X	CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131N075651474M
C623	283-0180-00	B010100	B139999X	CAP.,FXD,CER DI:5600PF,20%,200V	72982	8121N204651562M
C626	283-0341-00	B010100	B139999X	CAP.,FXD,CER DI:0.047UF,10%,100V	72982	8131N145W5R473K
C629	281-0638-00	B010100	B139999X	CAP.,FXD,CER DI:240PF,(NOM VALUE),SEL	72982	301000Z5D241J
C632	283-0341-00	B010100	B139999X	CAP.,FXD,CER DI:0.047UF,10%,100V	72982	8131N145W5R473K
C635	281-0638-00	B010100	B139999X	CAP.,FXD,CER DI:240PF,(NOM VALUE),SEL	72982	301000Z5D241J
C638	283-0203-00	B010100	B139999X	CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131N075651474M
C641	283-0180-00	B010100	B139999X	CAP.,FXD,CER DI:5600PF,20%,200V	72982	8121N204651562M
C644	283-0160-00	XB010160		CAP.,FXD,CER DI:1.5PF,10%,50V,(NOM VALUE),SEL	72982	8101A058C0K159B
C645	283-0000-00	B010100	B139999X	CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C657	283-0185-00			CAP.,FXD,CER DI:2.5PF,5%,50V	72982	8101A058C0K259B
C658	281-0151-00			CAP.,VAR,CER DI:1-3UF,100V	72982	518-600A1-3
C659	283-0185-00			CAP.,FXD,CER DI:2.5PF,5%,50V	72982	8101A058C0K259B
C662	281-0603-00			CAP.,FXD,CER DI:39PF,5%,500V	72982	308-000C0G0390J
C663	281-0603-00			CAP.,FXD,CER DI:39PF,5%,500V	72982	308-000C0G0390J
C670	281-0543-00			CAP.,FXD,CER DI:270PF,10%,500V	72982	301055X5P271K
C672	281-0543-00			CAP.,FXD,CER DI:270PF,10%,500V	72982	301055X5P271K
C675	283-0160-00			CAP.,FXD,CER DI:1.5PF,10%,50V	72982	8101A058C0K159B
C676	283-0181-00			CAP.,FXD,CER DI:1.8PF,10%,100V	72982	8101A108C0K189B
C680	283-0181-00			CAP.,FXD,CER DI:1.8PF,10%,100V	72982	8101A108C0K189B
C681	283-0160-00			CAP.,FXD,CER DI:1.5PF,10%,50V	72982	8101A058C0K159B
C685	281-0543-00			CAP.,FXD,CER DI:270PF,10%,500V	72982	301055X5P271K
C689	281-0543-00			CAP.,FXD,CER DI:270PF,10%,500V	72982	301055X5P271K
C733	283-0160-00			CAP.,FXD,CER DI:1.5PF,10%,50V	72982	8101A058C0K159B
C734	283-0181-00			CAP.,FXD,CER DI:1.8PF,10%,100V	72982	8101A108C0K189B
C736	283-0160-00	XB050000		CAP.,FXD,CER DI:1.5PF,10%,50V,(NOM VALUE),SEL	72982	8101A058C0K159B
C738	283-0181-00			CAP.,FXD,CER DI:1.8PF,10%,100V	72982	8101A108C0K189B
C739	283-0160-00			CAP.,FXD,CER DI:1.5PF,10%,50V	72982	8101A058C0K159B
C743	283-0128-00			CAP.,FXD,CER DI:100PF,5%,500V	72982	871-536T2H101J
C745	283-0114-00			CAP.,FXD,CER DI:0.0015UF,5%,200V	72982	805-509B152J
C747	283-0239-00			CAP.,FXD,CER DI:0.022UF,10%,50V	72982	8131N075WR5223K

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C749	283-0203-00			CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131N075651474M
C758	283-0108-00			CAP.,FXD,CER DI:220PF,10%,200V,(NOM VALUE),SEL	56289	272C13
C760	283-0180-00			CAP.,FXD,CER DI:5600PF,20%,200V	72982	8121N204651562M
C762	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C764	283-0212-00			CAP.,FXD,CER DI:2UF,20%,50V	72982	8141050651205M
C770	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
C783	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
C787	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
C789	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
C791	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
C794	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
C796	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
C798	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
C832	281-0505-00			CAP.,FXD,CER DI:12PF,+/-1.2PF,500V	72982	301-012C0G0120K
C838	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C843	281-0505-00			CAP.,FXD,CER DI:12PF,+/-1.2PF,500V	72982	301-012C0G0120K
C862	283-0674-00			CAP.,FXD,MICA D:85PF,1%,500V	00853	D155F850F0
C865	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C870	283-0615-00			CAP.,FXD,MICA D:33PF,5%,500V	00853	D155E330J0
C875	283-0615-00			CAP.,FXD,MICA D:33PF,5%,500V	00853	D155E330J0
C905	281-0092-00			CAP.,VAR,CER DI:9-35PF	72982	538-011E2P094R
C906	283-0616-00			CAP.,FXD,MICA D:75PF,5%,500V	00853	D155E750J0
C912	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C915	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C921	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C926[1]						
C928	281-0168-00			CAP.,VAR,AIR DI:1.3-5.4PF,250V	74970	187-0103-035
C934	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C940	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C943	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C946[1]						
C948	281-0168-00			CAP.,VAR,AIR DI:1.3-5.4PF,250V	74970	187-0103-035
C990	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C992	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020NLF
C994	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020NLF
C996	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020NLF
C998	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1002	281-0518-00			CAP.,FXD,CER DI:47PF,+/-9.4PF,500V	72982	301-000U2J0470M
C1009	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1015	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1016	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1018	281-0140-00			CAP.,VAR,CER DI:5-25PF,100V	72982	518-002-A5-25
C1021	281-0572-00			CAP.,FXD,CER DI:6.8PF,+/-0.5PF,500V	72982	301-000C0H0689D
C1029	281-0140-00			CAP.,VAR,CER DI:5-25PF,100V	72982	518-002-A5-25
C1032	281-0670-00			CAP.,FXD,CER DI:1.8PF,+/-0.1PF,500V	72982	374-005C0K0189B
C1039	281-0504-00			CAP.,FXD,CER DI:10PF,+/-1PF,500V	72982	301-055C0G0100F
C1042	281-0610-00			CAP.,FXD,CER DI:2.2PF,+/-0.1PF,500V	72982	374-001C0J0229B
C1046	290-0309-00			CAP.,FXD,ELCTLT:100UF,20%,25V	56289	109D107X0025F2
C1049	281-0504-00			CAP.,FXD,CER DI:10PF,+/-1PF,500V	72982	301-055C0G0100F
C1052	281-0518-00			CAP.,FXD,CER DI:47PF,+/-9.4PF,500V	72982	301-000U2J0470M
C1059	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1065	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1066	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z

[1] Part of ckt bd

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C1068	281-0504-00			CAP.,FXD,CER DI:10PF,+/-1PF,500V	72982	301-055C0G0100F
C1082	281-0534-00			CAP.,FXD,CER DI:3.3PF,+/-0.25PF,500V	72982	301-000C0J0339C
C1089	281-0504-00			CAP.,FXD,CER DI:10PF,+/-1PF,500V	72982	301-055C0G0100F
C1092	281-0534-00			CAP.,FXD,CER DI:3.3PF,+/-0.25PF,500V	72982	301-000C0J0339C
C1096	290-0309-00			CAP.,FXD,ELCTLT:100UF,20%,25V	56289	109D107X0025F2
C1099	281-0504-00			CAP.,FXD,CER DI:10PF,+/-1PF,500V	72982	301-055C0G0100F
C1114	283-0079-00			CAP.,FXD,CER DI:0.01UF,20%,250V	72982	8151B202C103M
C1115	283-0187-00			CAP.,FXD,CER DI:0.047UF,10%,400V	72982	8131N401X5R473K
C1116	283-0187-00			CAP.,FXD,CER DI:0.047UF,10%,400V	72982	8131N401X5R473K
C1117	283-0079-00			CAP.,FXD,CER DI:0.01UF,20%,250V	72982	8151B202C103M
C1127	281-0158-00			CAP.,VAR,CER DI:7-45PF,50V	72982	518-000G7-45
C1128	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C1129	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025NLF
C1134	283-0079-00			CAP.,FXD,CER DI:0.01UF,20%,250V	72982	8151B202C103M
C1135	283-0187-00			CAP.,FXD,CER DI:0.047UF,10%,400V	72982	8131N401X5R473K
C1136	283-0187-00			CAP.,FXD,CER DI:0.047UF,10%,400V	72982	8131N401X5R473K
C1137	283-0079-00			CAP.,FXD,CER DI:0.01UF,20%,250V	72982	8151B202C103M
C1146	283-0187-00			CAP.,FXD,CER DI:0.047UF,10%,400V	72982	8131N401X5R473K
C1147	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1148	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C1149	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025NLF
C1164	283-0079-00			CAP.,FXD,CER DI:0.01UF,20%,250V	72982	8151B202C103M
C1165	283-0187-00			CAP.,FXD,CER DI:0.047UF,10%,400V	72982	8131N401X5R473K
C1166	283-0187-00			CAP.,FXD,CER DI:0.047UF,10%,400V	72982	8131N401X5R473K
C1167	283-0079-00			CAP.,FXD,CER DI:0.01UF,20%,250V	72982	8151B202C103M
C1178	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C1179	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025NLF
C1184	283-0079-00			CAP.,FXD,CER DI:0.01UF,20%,250V	72982	8151B202C103M
C1185	283-0187-00			CAP.,FXD,CER DI:0.047UF,10%,400V	72982	8131N401X5R473K
C1186	283-0187-00			CAP.,FXD,CER DI:0.047UF,10%,400V	72982	8131N401X5R473K
C1187	283-0079-00			CAP.,FXD,CER DI:0.01UF,20%,250V	72982	8151B202C103M
C1196	283-0187-00			CAP.,FXD,CER DI:0.047UF,10%,400V	72982	8131N401X5R473K
C1197	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1198	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C1199	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025NLF
C1204[1]	285-1086-00			CAP.,FXD,PLSTC:0.68UF,20%,320V	50558	ECT285-1086-00
C1205	283-0022-00			CAP.,FXD,CER DIAC	91418	TYPEU-02GMV1400V
C1206	283-0022-00			CAP.,FXD,CER DIAC	91418	TYPEU-02GMV1400V
C1216	290-0628-00			CAP.,FXD,ELCTLT:950UF,+50-10%,200V	56289	36D7560
C1217	290-0628-00			CAP.,FXD,ELCTLT:950UF,+50-10%,200V	56289	36D7560
C1219	283-0057-00			CAP.,FXD,CER DI:0.1UF,+80-20%,200V	56289	274C10
C1227	283-0280-00			CAP.,FXD,CER DI:2200PF,10%,2000V	72982	818-002-Y550222K
C1228	283-0280-00			CAP.,FXD,CER DI:2200PF,10%,2000V	72982	818-002-Y550222K
C1229	285-0939-00			CAP.,FXD,PLSTC:3UF,5%,400V	14752	A1402
C1231	290-0395-00			CAP.,FXD,ELCTLT:4.7UF,20%,50V	56289	150D475X0050B2
C1235	283-0078-00			CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C1236	283-0280-00			CAP.,FXD,CER DI:2200PF,10%,2000V	72982	818-002-Y550222K
C1237	285-0938-00	B010100	B030201	CAP.,FXD,PLSTC:0.03UF,5%,600V	80009	285-0938-00
C1237	285-1089-00	B030202		CAP.,FXD,CARBON:0.04UF,5%,900V	50558	ECT285-1089-00
C1238	283-0279-00			CAP.,FXD,CER DI:0.001UF,20%,3000V	72982	878Y5S102M
C1239	290-0395-00			CAP.,FXD,ELCTLT:4.7UF,20%,50V	56289	150D475X0050B2
C1242	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
C1243	290-0159-00			CAP.,FXD,ELCTLT:2UF,+50-10%,150V	56289	30D205F150BB4
C1245	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z

[1]Option 5 only.

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C1249	290-0164-00			CAP.,FXD,ELCTLT:1UF,+50-10%,150V	56289	30D105F150BA2
C1253	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1254	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1256	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1259	290-0523-00			CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0025HA1
C1264	290-0573-00	B010100	B030211	CAP.,FXD,ELCTLT:2.7UF,20%,50V	56289	196D275X0050JA1
C1264	290-0524-00	B030121		CAP.,FXD,ELCTLT:4.7UF,20%,10V	90201	TDC475M010EL
C1267	290-0523-00			CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0025HA1
C1275	283-0060-00			CAP.,FXD,CER DI:100PF,5%,200V	72982	855-535U2J101J
C1276	283-0060-00			CAP.,FXD,CER DI:100PF,5%,200V	72982	855-535U2J101J
C1277	290-0572-00			CAP.,FXD,ELCTLT:0.1UF,20%,50V	56289	196D104X0050HA1
C1278	290-0572-00			CAP.,FXD,ELCTLT:0.1UF,20%,50V	56289	196D104X0050HA1
C1285	283-0092-00	B010100	B030211	CAP.,FXD,CER DI:0.03UF,+80-20%,200V	72982	845-534E303Z
C1285	283-0341-00	B030212		CAP.,FXD,CER DI:0.047UF,10%,100V	72982	8131N145W5R473K
C1298	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C1300	283-0078-00			CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C1301	283-0078-00			CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C1302	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1313	290-0630-00			CAP.,FXD,ELCTLT:300UF,+75-10%,12V	56289	432D123
C1314	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	56289	196D107X0020MA3
C1316	290-0425-00			CAP.,FXD,ELCTLT:100UF,20%,20V	90201	THF107M020P1G
C1317	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	56289	196D107X0020MA3
C1318	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	56289	196D107X0020MA3
C1326	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1328	290-0582-00			CAP.,FXD,ELCTLT:5UF,+75-10%,150V	56289	600D505G150KD4
C1330	290-0582-00			CAP.,FXD,ELCTLT:5UF,+75-10%,150V	56289	600D505G150KD4
C1331	283-0057-00			CAP.,FXD,CER DI:0.1UF,+80-20%,200V	56289	274C10
C1350	290-0425-00			CAP.,FXD,ELCTLT:100UF,20%,20V	90201	THF107M020P1G
C1351	290-0425-00			CAP.,FXD,ELCTLT:100UF,20%,20V	90201	THF107M020P1G
C1353	290-0574-00			CAP.,FXD,ELCTLT:47UF,10%,20V	56289	196D476X9020
C1354	290-0574-00			CAP.,FXD,ELCTLT:47UF,10%,20V	56289	196D476X9020
C1358	290-0194-00			CAP.,FXD,ELCTLT:10UF,+50-10%,100V	56289	30D106F100DC4
C1360	290-0270-00	B010100	B050299	CAP.,FXD,ELCTLT:8.2UF,20%,60V	56289	150D825X0060R2
C1360	290-0716-00	B050300		CAP.,FXD,ELCTLT:8.2UF,20%,75V	05397	T11C825M075AS
C1362	290-0194-00			CAP.,FXD,ELCTLT:10UF,+50-10%,100V	56289	30D106F100DC4
C1364	290-0270-00	B010100	B050299	CAP.,FXD,ELCTLT:8.2UF,20%,60V	56289	150D825X0060R2
C1364	290-0716-00	B050300		CAP.,FXD,ELCTLT:8.2UF,20%,75V	05397	T11C825M075AS
C1413	283-0078-00			CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C1416	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	72982	838-533B271J
C1436	283-0078-00			CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C1441	283-0078-00			CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C1451	283-0078-00			CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C1463	283-0078-00			CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C1481	283-0078-00			CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C1495	283-0078-00			CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C1506	283-0068-00			CAP.,FXD,CER DI:0.01UF,+100-0%,500V	56289	19C241
C1511	290-0572-00			CAP.,FXD,ELCTLT:0.1UF,20%,50V	56289	196D104X0050HA1
C1518	283-0078-00			CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C1533	283-0078-00			CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C1571	283-0128-00			CAP.,FXD,CER DI:100PF,5%,500V	72982	871-536T2H101J
C1603	281-0629-00			CAP.,FXD,CER DI:33PF,5%,600V	72982	308-000C0G0330J
C1605	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C1606	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z

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C1612	283-0116-00			CAP.,FXD,CER DI:820PF,5%,500V	72982	801-547B821J
C1613	290-0528-00			CAP.,FXD,ELCTLT:15UF,20%,50V	90201	TDC156M050WLC
C1618	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C1621	283-0264-00	B010100	B119999	CAP.,FXD,CER DI:1000PF,+80-20%,10,000V	72982	3910BW303C142K
C1621	283-0368-00	B120000		CAP.,FXD,CER DI:0.001UF,20%,12,000V	51406	DHR20Z5P102M
C1622	283-0008-00			CAP.,FXD,CER DI:0.1UF,500V	72982	8151N501 E104M
C1626	283-0264-00	B010100	B119999	CAP.,FXD,CER DI:1000PF,+80-20%,10,000V	72982	3910BW303C142K
C1626	283-0368-00	B120000		CAP.,FXD,CER DI:0.001UF,20%,12,000V	51406	DHR20Z5P102M
C1631	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C1635	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	72982	8131N075651224M
C1637	290-0528-00			CAP.,FXD,ELCTLT:15UF,20%,50V	90201	TDC156M050WLC
C1643	283-0264-00	B010100	B119999	CAP.,FXD,CER DI:1000PF,+80-20%,10,000V	72982	3910BW303C142K
C1643	283-0368-00	B120000		CAP.,FXD,CER DI:0.001UF,20%,12,000V	51406	DHR20Z5P102M
C1644	283-0264-00	B010100	B119999	CAP.,FXD,CER DI:1000PF,+80-20%,10,000V	72982	3910BW303C142K
C1644	283-0368-00	B120000		CAP.,FXD,CER DI:0.001UF,20%,12,000V	51406	DHR20Z5P102M
C1648	283-0264-00	B010100	B119999	CAP.,FXD,CER DI:1000PF,+80-20%,10,000V	72982	3910BW303C142K
C1648	283-0368-00	B120000		CAP.,FXD,CER DI:0.001UF,20%,12,000V	51406	DHR20Z5P102M
C1650	283-0264-00	B010100	B119999	CAP.,FXD,CER DI:1000PF,+80-20%,10,000V	72982	3910BW303C142K
C1650	283-0368-00	B120000		CAP.,FXD,CER DI:0.001UF,20%,12,000V	51406	DHR20Z5P102M
C1652	283-0008-00			CAP.,FXD,CER DI:0.1UF,500V	72982	8151N501 E104M
C1655	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1656	283-0041-00			CAP.,FXD,CER DI:0.0033UF,5%,500V	72982	841-541B332J
C1657	283-0264-00	B010100	B119999	CAP.,FXD,CER DI:1000PF,+80-20%,10,000V	72982	3910BW303C142K
C1657	283-0368-00	B120000		CAP.,FXD,CER DI:0.001UF,20%,12,000V	51406	DHR20Z5P102M
C1662	283-0264-00	B010100	B119999	CAP.,FXD,CER DI:1000PF,+80-20%,10,000V	72982	3910BW303C142K
C1662	283-0368-00	B120000		CAP.,FXD,CER DI:0.001UF,20%,12,000V	51406	DHR20Z5P102M
C1665	283-0264-00	B010100	B119999	CAP.,FXD,CER DI:1000PF,+80-20%,10,000V	72982	3910BW303C142K
C1665	283-0368-00	B120000		CAP.,FXD,CER DI:0.001UF,20%,12,000V	51406	DHR20Z5P102M
C1666	283-0264-00	B010100	B119999	CAP.,FXD,CER DI:1000PF,+80-20%,10,000V	72982	3910BW303C142K
C1666	283-0368-00	B120000		CAP.,FXD,CER DI:0.001UF,20%,12,000V	51406	DHR20Z5P102M
C1667	283-0264-00	B010100	B119999	CAP.,FXD,CER DI:1000PF,+80-20%,10,000V	72982	3910BW303C142K
C1667	283-0368-00	B120000		CAP.,FXD,CER DI:0.001UF,20%,12,000V	51406	DHR20Z5P102M
C1672	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1678	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1679	283-0065-00			CAP.,FXD,CER DI:0.001UF,5%,100V	72982	805-505B102J
C1680	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1682	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1683	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1688	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C1692	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C1695	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C1696	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C1700	281-0546-00			CAP.,FXD,CER DI:330PF,10%,500V	04222	7001-1380
C1701	281-0089-00			CAP.,VAR,CER DI:2-8PF	72982	538-006-89A
C1703	281-0089-00			CAP.,VAR,CER DI:2-8PF	72982	538-006-89A
C1705	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C1707	281-0661-00			CAP.,FXD,CER DI:0.8PF,+/-0.1PF,500V	72982	301-000C0K0808B
C1711	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C1714	283-0113-00			CAP.,FXD,CER DI:56PF,1%,500V	72982	851-559A560F
C1720	283-0150-00			CAP.,FXD,CER DI:650PF,5%,200V	72982	835-515B651J
C1721	281-0627-00			CAP.,FXD,CER DI:1PF,+/-0.25PF,500V	72982	301-000C0K0109C
C1723	281-0627-00			CAP.,FXD,CER DI:1PF,+/-0.25PF,500V	72982	301-000C0K0109C
C1744	283-0119-00			CAP.,FXD,CER DI:2200PF,5%,200V	72982	855-535B222J

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C1749	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C1762	290-0244-00			CAP.,FXD,ELCTLT:0.47UF,5%,35V	56289	162D474X5035BC2
C1780	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1783	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C1785	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C1786	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C1787	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C1789	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1790	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1791	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1792	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1793	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1794	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1795	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1797	290-0267-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	162D105X0035CD2
C1798	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1799	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1806	283-0128-00			CAP.,FXD,CER DI:100PF,5%,500V	72982	871-536T2H101J
C1814	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C1817	283-0110-00			CAP.,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C1822	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1831	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1832	281-0603-00			CAP.,FXD,CER DI:39PF,5%,500V	72982	308-000C0G0390J
C1836	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1842	283-0211-00	B010100	B010111X	CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1844	283-0211-00	B010100	B010111X	CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1849	290-0397-00			CAP.,FXD,ELCTLT:1UF,+50-10%,450V	56289	34D105F450EE4
C1860	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1861	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1863	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1865	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1867	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1868	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1885	281-0529-00			CAP.,FXD,CER DI:1.5PF,0.25PF,500V	72982	301-000C0K0159C
C1886	281-0594-00	XB010112		CAP.,FXD,CER DI:150PF,5%,100V	95275	VY04C151J
C1892	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C1893	281-0504-00			CAP.,FXD,CER DI:10PF,+/-1PF,500V	72982	301-055C0G0100F
C1899	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C1901	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1903	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C1923	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C1937	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1938	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1940	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1943	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1944	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N227C104K
C1946	283-0068-00			CAP.,FXD,CER DI:0.01UF,+100-0%,500V	56289	19C241
C1955	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C1956	285-0808-00			CAP.,FXD,PLSTC:0.1UF,10%,50V	56289	LP66A1A104K004
C1958	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C1961	281-0557-00			CAP.,FXD,CER DI:1.8PF,10%,500V	72982	301-000C0K0189B
C1965	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1971	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025NLF

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C1976	281-0509-00			CAP.,FXD,CER DI:15PF,+/-1.5PF,500V	72982	301-000C0G0150K
C1977	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C1981	281-0627-00			CAP.,FXD,CER DI:1PF,+/-0.25PF,500V	72982	301-000C0K0109C
C1983	281-0512-00			CAP.,FXD,CER DI:27PF,+/-2.7PF,500V	72982	308-000C0G0270K
C1991	290-0531-00			CAP.,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010WLC
C1993	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1995	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1996	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1997	290-0531-00			CAP.,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010WLC
C1998	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025NLF
C1999	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025NLF
C2133	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C2137	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N058651103M
C2138	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N058651103M
C2158	283-0194-00			CAP.,FXD,CER DI:4.7UF,20%,50V	72982	8151N080651475M
C2173	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C2177	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N058651103M
C2178	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N058651103M
C2198	283-0194-00			CAP.,FXD,CER DI:4.7UF,20%,50V	72982	8151N080651475M
C2203	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C2208	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C2209	283-0023-00	B010100	B010111X	CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C2217	283-0603-00			CAP.,FXD,MICA D:113PF,2%,300V	00853	D153F1130G0
C2218	283-0730-00			CAP.,FXD,MICA D:274PF,1%,500V	00853	D155E2740F0
C2220	281-0536-00			CAP.,FXD,CER DI:1000PF,10%,500V	72982	301055X5P102K
C2229	281-0536-00			CAP.,FXD,CER DI:1000PF,10%,500V	72982	301055X5P102K
C2232	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C2233	281-0592-00			CAP.,FXD,CER DI:4.7PF,+/-0.5PF,500V	72982	301-023C0H0479D
C2235	281-0670-00			CAP.,FXD,CER DI:1.8PF,+/-0.1PF,500V	72982	374-005C0K0189B
C2247	281-0536-00			CAP.,FXD,CER DI:1000PF,10%,500V	72982	301055X5P102K
C2251	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C2255	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C2270	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C2296	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C2300	281-0523-00	B010100	B010111X	CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C2304	281-0519-00	B010100	B010111X	CAP.,FXD,CER DI:47PF,+/-4.7PF,500V	72982	308-000C0G0470K
C2306	283-0596-00	B010100	B010111X	CAP.,FXD,MICA D:528PF,1%,300V	00853	D153F5280F0
C2308	290-0527-00	XB010112	B010141	CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020NLF
C2308	290-0519-00	B010142		CAP.,FXD,ELCTLT:100UF,20%,20V	56289	196D107X0020MA3
C2309	283-0111-00	B010100	B010111X	CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C2310	281-0605-00	XB010112		CAP.,FXD,CER DI:200PF,10%,500V	04222	7001-1375
C2312	290-0536-00	B010100	B010111	CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025NLF
C2312	281-0543-00	B010112		CAP.,FXD,CER DI:270PF,10%,500V	72982	301055X5P271K
C2314	281-0584-00	XB010112		CAP.,FXD,CER DI:100PF,5%,500V	72982	301-000Y5D0101J
C2317	281-0662-00	B010100	B010111X	CAP.,FXD,CER DI:10PF,+/-0.5PF,500V	72982	301-000H3M0100D
C2356	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C2358	290-0532-00			CAP.,FXD,ELCTLT:150UF,20%,6V	90201	TDC157M006CL
C2361	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025NLF
C2380	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C2381	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C2382	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C2383	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C2384	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z

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C2385	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C2386	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C2388	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C2389	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C2390	290-0530-00			CAP.,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
C2391	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C2393	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C2394	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C2395	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C2396	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C2397	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C2398	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C2402	281-0572-00	XB010142		CAP.,FXD,CER DI:6.8PF,+/-0.5PF,500V	72982	301-000C0H0689D
C2405	283-0111-00	XB010142		CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C2406	283-0111-00	XB010142		CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C2417	283-0594-00	B010100	B010141X	CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C2419	283-0594-00	XB010142		CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C2424	283-0655-00	B010100	B010141X	CAP.,FXD,MICA D:0.0033UF,1%,500V	00853	D195F332F0
C2425	283-0655-00	XB010142		CAP.,FXD,MICA D:0.0033UF,1%,500V	00853	D195F332F0
C2427	281-0536-00			CAP.,FXD,CER DI:1000PF,10%,500V	72982	301055X5P102K
C2432	281-0536-00			CAP.,FXD,CER DI:1000PF,10%,500V	72982	301055X5P102K
C2438	281-0630-00			CAP.,FXD,CER DI:390PF,5%,500V	72982	630000Y5D391J
C2442	281-0511-00	B010100	B129999X	CAP.,FXD,CER DI:22PF,+/-2.2PF,500V	72982	301-000C0G0220K
C2446	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C2459	281-0536-00			CAP.,FXD,CER DI:1000PF,10%,500V	72982	301055X5P102K
C2466	285-0808-00			CAP.,FXD,PLSTC:0.1UF,10%,50V	56289	LP66A1A104K004
C2495	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C2496	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C2503	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C2518	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C2519	283-0617-00			CAP.,FXD,MICA D:4700PF,10%,300V	00853	D193F472K0
C2525	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C2526	281-0509-00			CAP.,FXD,CER DI:15PF,+/-1.5PF,500V	72982	301-000C0G0150K
C2569	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C2585	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C2608	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C2613	281-0519-00			CAP.,FXD,CER DI:47PF,+/-4.7PF,500V	72982	308-000C0G0470K
C2625	283-0593-00			CAP.,FXD,MICA D:0.01UF,1%,100V	00853	D301F103F0
C2660	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C2681	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C2683	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C2684	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025NLF
C2686	290-0531-00			CAP.,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010WLC
C2687	290-0531-00			CAP.,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010WLC
C2688	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C2689	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C2690	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C2691	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C2692	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C2696	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C2698	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C2701	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
C2702	283-0637-00			CAP.,FXD,MICA D:20PF,2.5%,100V	00853	D151E200D0

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C2704	283-0103-00			CAP.,FXD,CER DI:180PF,5%,500V	56289	40C638
C2708	283-0605-00			CAP.,FXD,MICA D:678PF,1%,300V	00853	D153F6780F0
C2710	285-0698-00			CAP.,FXD,PLSTC:0.0082UF,5%,100V	56289	410P82251
C2714	283-0010-00			CAP.,FXD,CER DI:0.05UF,+100-20%,50V	56289	273C20
C2716	290-0114-00			CAP.,FXD,ELCTLT:47UF,20%,6V	56289	150D476X0006B2
C2724	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C2726	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C2730	281-0629-00	B010100	B090341	CAP.,FXD,CER DI:33PF,5%,600V	72982	308-000C0G0330J
C2730	283-0639-00	B090342		CAP.,FXD,MICA D:56PF,1%,100V	00853	D151E560F0
C2749	281-0546-00			CAP.,FXD,CER DI:330PF,10%,500V	04222	7001-1380
C2762	285-0901-00			CAP.,FXD,PLSTC:0.047UF,5%,50V	56289	LP88A1A473J
C2771	285-0919-00			CAP.,FXD,PLSTC:0.22UF,10%,100V	56289	LP66A1B224K002
C2782	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C2783	281-0180-00			CAP.,VAR,MICA D:18-115PF,175V	72136	T50607-2
C2786	283-0645-00			CAP.,FXD,MICA D:790PF,1%,100V	00853	D151E791F0
C2791	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
C2793	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	72982	8131N075651224M
C2794	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
C2797	290-0326-00	B010100	B010141	CAP.,FXD,ELCTLT:820UF,10%,6V	56289	109D827X9006F2
C2797	290-0708-00	B010142		CAP.,FXD,ELCTLT:820UF,20%,6V	56289	109D827X0006F2
C2798	290-0114-00			CAP.,FXD,ELCTLT:47UF,20%,6V	56289	150D476X0006B2
C2803	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C2807	283-0697-00			CAP.,FXD,MICA D:545PF,1%,300V	09023	CD15EC545F03
C2810	283-0651-00	XB010142		CAP.,FXD,MICA D:430PF,1%,500V	00853	D155F431F0
C2811	283-0598-00	B010100	B010141	CAP.,FXD,MICA D:253PF,5%,300V	00853	D153E253GJ0
C2811	283-0604-00	B010142		CAP.,FXD,MICA D:304PF,2%,300V	00853	D153F304GG0
C2817	281-0523-00	XB010142		CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C2818	283-0691-00	XB010142		CAP.,FXD,MICA D:650PF,1%,300V	72136	DM15F651F0300
C2825	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C2828	281-0562-00	B010100	B019999	CAP.,FXD,CER DI:39PF,10%,500V	72982	301-000U2J0390K
C2828	281-0584-00	B020000		CAP.,FXD,CER DI:100PF,5%,500V	72982	301-000Y5D0101J
C2865	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C2877	283-0645-00			CAP.,FXD,MICA D:790PF,1%,100V	00853	D151E791F0
C2898	290-0326-00	B010100	B010141	CAP.,FXD,ELCTLT:820UF,10%,6V	56289	109D827X9006F2
C2898	290-0708-00	B010142		CAP.,FXD,ELCTLT:820UF,20%,6V	56289	109D827X0006F2
C2902	285-0598-00			CAP.,FXD,PLSTC:0.01UF,5%,100V	01002	61F10AC103
C2916	283-0065-00	B010100	B019999	CAP.,FXD,CER DI:0.001UF,5%,100V	72982	805-505B102J
C2916	281-0580-00	B020000		CAP.,FXD,CER DI:470PF,10%,500V	04222	7001-1374
C2923	283-0599-00	B010100	B019999	CAP.,FXD,MICA D:98PF,5%,500V	00853	D105E980J0
C2923	283-0065-00	B020000		CAP.,FXD,CER DI:0.001UF,5%,100V	72982	805-505B102J
C2939	283-0599-00			CAP.,FXD,MICA D:98PF,5%,500V	00853	D105E980J0
C2942	283-0599-00			CAP.,FXD,MICA D:98PF,5%,500V	00853	D105E980J0
C2996	290-0326-00	B010100	B010141	CAP.,FXD,ELCTLT:820UF,10%,6V	56289	109D827X9006F2
C2996	290-0708-00	B010142	B010191	CAP.,FXD,ELCTLT:820UF,20%,6V	56289	109D827X0006F2
C2996	290-0139-00	B010192	B019999	CAP.,FXD,ELCTLT:180UF,20%,6V	12954	D180C6M1
C2996	290-0708-00	B020000		CAP.,FXD,ELCTLT:820UF,20%,6V	56289	109D827X0006F2
C3112	290-0326-00	B010100	B010141	CAP.,FXD,ELCTLT:820UF,10%,6V	56289	109D827X9006F2
C3112	290-0708-00	B010142		CAP.,FXD,ELCTLT:820UF,20%,6V	56289	109D827X0006F2
C3211	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C3231	283-0604-00			CAP.,FXD,MICA D:304PF,2%,300V	00853	D153F3040GG0
C3234	290-0652-00			CAP.,FXD,ELCTLT:5UF,+50-10%,450V	56289	30D501
C3235	290-0652-00			CAP.,FXD,ELCTLT:5UF,+50-10%,450V	56289	30D501
C3244	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P

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C3248	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C3249	283-0189-00			CAP.,FXD,CER DI:0.1UF,20%,400V	72982	8151N401X5R104M
C3401	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C3407	283-0597-00			CAP.,FXD,MICA D:470PF,10%,300V	00853	D153E471K0
C3418	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C3420	283-0597-00			CAP.,FXD,MICA D:470PF,10%,300V	00853	D153E471K0
C3429	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C3434	285-0698-00			CAP.,FXD,PLSTC:0.0082UF,5%,100V	56289	410P82251
C3438	281-0612-00			CAP.,FXD,CER DI:5.6PF,+/-0.5PF,500V	72982	374-001C0H0569D
C3440	283-0077-00	XB130000		CAP.,FXD,CER DI:330PF,5%,500V	56289	40C94A3
C3443	283-0103-00			CAP.,FXD,CER DI:180PF,5%,500V	56289	40C638
C3445	283-0103-00			CAP.,FXD,CER DI:180PF,5%,500V	56289	40C638
C3449	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C3470	290-0523-00			CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0025HA1
C3471	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C3472	290-0523-00			CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0025HA1
C3475	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C3803	283-0077-00	XB130000		CAP.,FXD,CER DI:330PF,5%,500V	56289	40C94A3
C4401	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C4403	283-0077-00	XB130000		CAP.,FXD,CER DI:330PF,5%,500V	56289	40C94A3
C4407	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	04222	7001-1364
C4418	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C4420	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	04222	7001-1364
C4429	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C4434	285-0698-00			CAP.,FXD,PLSTC:0.0082UF,5%,100V	56289	410P82251
C4438	281-0504-00			CAP.,FXD,CER DI:10PF,+/-1PF,500V	72982	301-055C0G0100F
C4442	283-0299-00			CAP.,FXD,CER DI:51PF,5%,500V	72982	8121N501A510J
C4443	283-0103-00			CAP.,FXD,CER DI:180PF,5%,500V	56289	40C638
C4475	283-0047-00			CAP.,FXD,CER DI:270PF,5%,500V	72982	861-518B271J
C4477	283-0047-00			CAP.,FXD,CER DI:270PF,5%,500V	72982	861-518B271J
C4479	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C4485	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C4490	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C4492	290-0523-00			CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0025HA1
C4494	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C4495	290-0523-00			CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0025HA1
C4521	283-0110-00	XB090000		CAP.,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C4524	283-0110-00	XB090000		CAP.,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C4527	283-0110-00	XB090000		CAP.,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C4532	283-0024-00	XB090000		CAP.,FXD,CER DI:0.1UF,+80-20%,30V	72982	814N039-E-104Z
C4541	283-0191-00	XB090000		CAP.,FXD,CER DI:0.022UF,20%,50V	72982	8121N063651223M
C4542	283-0191-00	XB090000		CAP.,FXD,CER DI:0.022UF,20%,50V	72982	8121N063651223M
C4571	283-0219-00	XB090000		CAP.,FXD,CER DI:1500PF,20%,50V	93958	51451-1
C4575	283-0219-00	XB090000		CAP.,FXD,CER DI:1500PF,20%,50V	93958	51451-1
C4605	281-0788-00	XB140000		CAP.,FXD,CER DI:470PF,10%,100V	72982	390-049X54471K
C4610	283-0114-00	XB140000		CAP.,FXD,CER DI:0.0015UF,5%,200V	72982	805-509B152J
C4611	283-0268-00	XB140000		CAP.,FXD,CER DI:0.015UF,10%,50V	72982	8131N075W5R153K
C4613	281-0788-00	XB140000		CAP.,FXD,CER DI:470PF,10%,100V	72982	390-049X54471K
C4665	281-0788-00	XB140000		CAP.,FXD,CER DI:470PF,10%,100V	72982	390-049X54471K
C4673	281-0788-00	XB140000		CAP.,FXD,CER DI:470PF,10%,100V	72982	390-049X54471K
C4677	283-0114-00	XB140000		CAP.,FXD,CER DI:0.0015UF,5%,200V	72982	805-509B152J
C4678	283-0268-00	XB140000		CAP.,FXD,CER DI:0.015UF,10%,50V	72982	8131N075W5R153K

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CR10	152-0423-00			SEMICOND DEVICE:SILICON,300V,3A	04713	1N5000
CR11	152-0423-00			SEMICOND DEVICE:SILICON,300V,3A	04713	1N5000
CR42	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR70	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR94	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR95	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR104	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR113	152-0075-00			SEMICOND DEVICE:GE,25V,40MA	80009	152-0075-00
CR139	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR145	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR155	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR161	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR165	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR168	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR169	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR201	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR202	152-0141-02	B010100	B010101X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR204	152-0141-02	XB010102		SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR205	152-0141-02	XB010102		SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR218	152-0140-01	XB010102		SEMICOND DEVICE:TUNNEL,8PF,10MA	03508	SMTD905
CR225	152-0141-02	XB010102		SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR226	152-0322-00	B010100	B010101X	SEMICOND DEVICE:SILICON,15V	28480	5082-2672
CR235	152-0322-00	B010100	B010101X	SEMICOND DEVICE:SILICON,15V	28480	5082-2672
CR238	152-0322-00	B010100	B010101X	SEMICOND DEVICE:SILICON,15V	28480	5082-2672
CR263	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR292	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR296	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR297	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR302	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR303	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR304	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR305	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR306	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR314	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR315	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR336	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR340	152-0457-00			SEMICOND DEVICE:SILICON	28480	5082-2671
CR351	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR365	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR414	152-0501-00			SEMICOND DEVICE:SILICON,70V,200MA	04713	SSD2405
CR442	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR443	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR444	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR445	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR446	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR454	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR458	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR460	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR473	152-0246-00	B010100	B010116	SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR473	152-0245-00	B010117		SEMICOND DEVICE:SILICON,10NA,5V	07910	CD61165
CR475	152-0246-00	B010100	B010116	SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR475	152-0245-00	B010117		SEMICOND DEVICE:SILICON,10NA,5V	07910	CD61165
CR485	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676

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CR505	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR564	152-0501-00			SEMICOND DEVICE:SILICON,70V,200MA	04713	SSD2405
CR615	152-0141-02	B010100	B139999X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR787	152-0141-02	XB060000	B089999X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR859	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR882	152-0322-00			SEMICOND DEVICE:SILICON,15V	28480	5082-2672
CR887	152-0322-00			SEMICOND DEVICE:SILICON,15V	28480	5082-2672
CR889	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR890	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR892	152-0322-00			SEMICOND DEVICE:SILICON,15V	28480	5082-2672
CR896	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR897	152-0322-00			SEMICOND DEVICE:SILICON,15V	28480	5082-2672
CR898	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR902	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR908	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1016	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1020	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1035	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1046	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1066	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1070	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1085	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1096	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1113	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1133	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1163	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1183	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1215	152-0396-01			SEMICOND DEVICE:SILICON,400V,3A	12969	652-821
CR1232	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1234	152-0400-00			SEMICOND DEVICE:SILICON,400V,1A	80009	152-0400-00
CR1238	152-0401-00			SEMICOND DEVICE:SILICON,3-LAYER,TRIGGER	04713	MPT32
CR1240	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1241	152-0400-00			SEMICOND DEVICE:SILICON,400V,1A	80009	152-0400-00
CR1242	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1244	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1249	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	80009	152-0061-00
CR1251	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	80009	152-0061-00
CR1252	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	80009	152-0061-00
CR1253	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1256	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1259	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1280	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	80009	152-0333-00
CR1281	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	80009	152-0333-00
CR1282	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	80009	152-0333-00
CR1283	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	80009	152-0333-00
CR1288	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	80009	152-0333-00
CR1289	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	80009	152-0333-00
CR1290	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	80009	152-0333-00
CR1294	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1302	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1306	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1310	152-0540-00			SEMICOND DEVICE:RECTIFIER,20V,25A,MBD5400	04713	1N5289
CR1311	152-0502-00			SEMICOND DEVICE:SILICON,20V,5A	04713	1N5823

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR1312	152-0502-00			SEMICOND DEVICE:SILICON,20V,5A	04713	1N5823
CR1313	152-0540-00			SEMICOND DEVICE:RECTIFIER,20V,25A,MBD5400	04713	1N5829
CR1320 CR1321 CR1322 CR1323	153-0052-00			SEMICOND DVC SE:FOUR MATCHED DIODES	80009	153-0052-00
CR1325	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	80009	152-0061-00
CR1326	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	80009	152-0061-00
CR1340	152-0414-00			SEMICOND DEVICE:SILICON,200V,0.75A	80009	152-0414-00
CR1341	152-0414-00			SEMICOND DEVICE:SILICON,200V,0.75A	80009	152-0414-00
CR1342	152-0414-00			SEMICOND DEVICE:SILICON,200V,0.75A	80009	152-0414-00
CR1343	152-0414-00			SEMICOND DEVICE:SILICON,200V,0.75A	80009	152-0414-00
CR1345	152-0397-00			SEMICOND DEVICE:SILICON,50V,12A	04713	MR880
CR1346	152-0397-00			SEMICOND DEVICE:SILICON,50V,12A	04713	MR880
CR1347	152-0397-00			SEMICOND DEVICE:SILICON,50V,12A	04713	MR880
CR1348	152-0397-00			SEMICOND DEVICE:SILICON,50V,12A	04713	MR880
CR1402	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1410	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1429	152-0066-01			SEMICOND DEVICE:SILICON,400V,750MA	14099	SM4
CR1431	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1439	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1445	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1459	152-0066-01			SEMICOND DEVICE:SILICON,400V,750MA	14099	SM4
CR1468	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1469	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1482	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1483	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1489	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1499	152-0066-01			SEMICOND DEVICE:SILICON,400V,750MA	14099	SM4
CR1502	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1503	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1506	152-0233-00			SEMICOND DEVICE:SILICON,85V,100MA	07910	CD61128
CR1510	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1520	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1521	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1523	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1539	152-0066-01			SEMICOND DEVICE:SILICON,400V,750MA	14099	SM4
CR1576	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1589	152-0066-01			SEMICOND DEVICE:SILICON,400V,750MA	14099	SM4
CR1607	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1608	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1621	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR1622	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR1623	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR1624	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR1640	152-0409-00			SEMICOND DEVICE:SILICON,12,000V,5MA	83003	VG-12X
CR1642	152-0409-00			SEMICOND DEVICE:SILICON,12,000V,5MA	83003	VG-12X
CR1643	152-0409-00			SEMICOND DEVICE:SILICON,12,000V,5MA	83003	VG-12X
CR1644	152-0409-00			SEMICOND DEVICE:SILICON,12,000V,5MA	83003	VG-12X
CR1646	152-0409-00			SEMICOND DEVICE:SILICON,12,000V,5MA	83003	VG-12X
CR1647	152-0409-00			SEMICOND DEVICE:SILICON,12,000V,5MA	83003	VG-12X
CR1648	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR1652	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR1656	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR1658	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR1690	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1696	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	80009	152-0061-00
CR1709	152-0233-00			SEMICOND DEVICE:SILICON,85V,100MA	07910	CD61128
CR1716	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1717	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1718	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1724	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	02735	37304
CR1729	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	02735	37304
CR1734	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1735	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1737	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1742	152-0413-00	XB020000		SEMICOND DEVICE:SILICON,400V,750MA	80009	152-0413-00
CR1744	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1745	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1769	150-1004-00			LAMP,LED:RED,2.5V,15MA	08806	SSL-12
CR1821	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1834	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1844	152-0141-02	B010100	B010111X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1851	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1875	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1876	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1905	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1907	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1913	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1915	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1925	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1927	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1933	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR1935	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2205 [1]	108-0764-00			COIL,RF:FOCUS,2.2MH	80009	108-0764-00
CR2253	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2262	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2287	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2327	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2328	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2329	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2343	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2344	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2347	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2348	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2407	152-0141-02	B010100	B010141X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2414	152-0141-02	XB010142		SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2442	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2468	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2469	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2479	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2480	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2483	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2494	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2495	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2496	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152

[1]Furnished as a unit with L1821 and L2205

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR2497	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2498	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2524	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2557	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2558	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2594	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR2595	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR2599	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2600	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR2610	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2617	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2657	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2658	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2660	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2701	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2714	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2718	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2719	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2720	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2721	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2722	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2726	152-0141-02	XB090342		SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2730	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2731	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2762	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2997	152-0066-01	XB010142		SEMICOND DEVICE:SILICON,400V,750MA	14099	SM4
CR2998	152-0066-01	XB010142		SEMICOND DEVICE:SILICON,400V,750MA	14099	SM4
CR3206	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3224	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	02735	37304
CR3231	152-0400-00			SEMICOND DEVICE:SILICON,400V,1A	80009	152-0400-00
CR3232	152-0400-00			SEMICOND DEVICE:SILICON,400V,1A	80009	152-0400-00
CR3233	152-0400-00			SEMICOND DEVICE:SILICON,400V,1A	80009	152-0400-00
CR3234	152-0400-00			SEMICOND DEVICE:SILICON,400V,1A	80009	152-0400-00
CR3245	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3247	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	80009	152-0061-00
CR3369	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3379	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3381	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3384	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3387	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3416	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3431	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3432	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3433	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3438	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3439	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3441	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3442	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3443	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3445	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR3447	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4416[1]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4438[1]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152

[1] Option 20 only

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR4439[1]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4442[1]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4443[1]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4653	152-0075-00	XB140000		SEMICOND DEVICE:GE,25V,40MA	80009	152-0075-00
CR4654	152-0075-00	XB140000		SEMICOND DEVICE:GE,25V,40MA	80009	152-0075-00
DL650	119-0437-00			DELAY LINE:MAIN	80009	119-0437-00
DS250	150-0057-02			LAMP,INCAND:	80009	150-0057-02
DS252	150-0057-02			LAMP,INCAND:	80009	150-0057-02
DS254	150-0057-02			LAMP,INCAND:	80009	150-0057-02
DS1208	119-0181-00			SURGE VOLTAGE P:230VAC,+/-15%	80009	119-0181-00
DS1213	119-0181-00			SURGE VOLTAGE P:230VAC,+/-15%	80009	119-0181-00
DS1219	150-0035-00			LAMP,GLOW:90V,0.3MA	08806	A1D-T
E1652	119-0429-00			ARSR,ELEC SURGE:	25088	B1-C145T
E1656	119-0429-00			ARSR,ELEC SURGE:	25088	B1-C145T
E1658	119-0429-00			ARSR,ELEC SURGE:	25088	B1-C145T
E1659	119-0429-00			ARSR,ELEC SURGE:	25088	B1-C145T
E1661	119-0429-00			ARST,ELEC SURGE:	25088	B1-C145T
E1663	119-0430-00			ARSR,ELEC SURGE:	25088	B1-F90
F1200	159-0017-00			FUSE,CARTRIDGE:3AG,4A,250V,FAST BLOW	71400	MTH4
FL1200	119-0420-00			FILTER,RFI:	05245	6EF1
J1	131-0767-05			CONNECTOR,RCPT,:	80009	131-0767-05
J2	131-0767-07			CONNECTOR,RCPT,:PLUG-IN CKT BD,70 CONTACT	80009	131-0767-07
J88	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J89	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J98	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J99	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J102	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J104	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J123	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J137	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J156	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J170	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J181	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J182	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J238	131-1003-00	B010100	B010101X	CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J239	131-1315-00			CONNECTOR,RCPT,:BNC,FEMALE	80009	131-1315-00
J243	131-1003-00	XB010102		CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J257	131-0771-00			CONNECTOR,RCPT,:4 CONT,QUICK DISCONNECT	80009	131-0771-00
J280	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J297	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J298	131-1146-00			CONTACT,ELEC:FEMALE	71468	030-1953-00
J370	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J385	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J520	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J535	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J575	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J576	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J601	131-1003-00	B010100	B139999X	CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J604	131-1003-00	B010100	B139999X	CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J607	131-1003-00	B010100	B139999X	CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00

[1]Option 20 only

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
J610	131-1003-00	B010100	B139999X	CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J643	131-1003-00	B010100	B139999X	CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J645	131-1003-00	B010100	B139999X	CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J660	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J661	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J690	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J704	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J719	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J848	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J849	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J850	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J853	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J857	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J1075	136-0089-00			CONNECTOR,RCPT,:MOUNT:9 PIN CHASSISMOUNT	02660	165-16
J1670	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J1674	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J1735	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J1737	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J1786	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J1877	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J1946	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J1994	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J2212	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J2217	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J2238	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J2258	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J2259	131-1146-00			CONTACT,ELEC:FEMALE	71468	030-1953-00
J2317	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J2320	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J2321	131-1146-00			CONTACT,ELEC:FEMALE	71468	030-1953-00
J2326	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J2329	131-1146-00			CONTACT,ELEC:FEMALE	71468	030-1953-00
J2347	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J2359	131-1146-00			CONTACT,ELEC:FEMALE	71468	030-1953-00
J2442	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J2443	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J2548	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J2558	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3110	131-1409-00			CONN,RCPT,ELEC:30/60 DBL ROW CONTACT	05574	3VH30/1JV3
J3120	131-1409-00			CONN,RCPT,ELEC:30/60 DBL ROW CONTACT	05574	3VH30/1JV3
J3130	131-1409-00			CONN,RCPT,ELEC:30/60 DBL ROW CONTACT	05574	3VH30/1JV3
J3140	131-1409-00			CONN,RCPT,ELEC:30/60 DBL ROW CONTACT	05574	3VH30/1JV3
J3366	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3376	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3401	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3402	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3403	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3404	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3405	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3504	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3505	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3506	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3507	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
J3508	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3509	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3516	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3517	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3518	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3520	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3521	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3522	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3523	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3524	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J3610	131-1146-00			CONTACT,ELEC:FEMALE	71468	030-1953-00
J3611	131-1146-00			CONTACT,ELEC:FEMALE	71468	030-1953-00
J3630	131-1278-00			CONN,HOUSING:50 SOCKETS	00779	205211-1
J3650	131-1405-00			CONN,RCPT,ELEC:104 SOCKETS	00779	206337-1
J4502	131-1003-00	XB090000		CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J4503	131-1003-00	XB090000		CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J4588	131-1003-00	XB090000		CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J4589	131-1003-00	XB090000		CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
K454	108-0287-00			COIL,FXD:REED DRIVE,SINGLE	80009	108-0287-00
K454-S1	260-0721-00			SWITCH,REED:SPDD,35A	12617	MRH-DT
L14	108-0245-00			COIL,RF:3.9UH	80009	108-0245-00
L15	108-0245-00			COIL,RF:3.9UH	80009	108-0245-00
L17	108-0245-00			COIL,RF:3.9UH	80009	108-0245-00
L27	108-0245-00			COIL,RF:3.9UH	80009	108-0245-00
L32	108-0245-00			COIL,RF:3.9UH	80009	108-0245-00
L133	108-0245-00			COIL,RF:3.9UH	80009	108-0245-00
L204	108-0443-00	XB010102	B159999	COIL,RF:25UH	80009	108-0443-00
L204	108-0226-00	B160000		COIL,RF:100UH	76493	DWG B4257
L243	120-0285-00	B010100	B010101X	XFMR,TOROID:4 TURNS SINGLE	80009	120-0285-00
L291	276-0528-00	XB010112		SHIELDING BEAD,:0.1UH	80009	276-0528-00
L660	108-0369-00			COIL,RF:0.12UH	80009	108-0369-00
L661	108-0369-00			COIL,RF:0.12UH	80009	108-0369-00
L667	114-0220-00	B010100	B049999	COIL,RF:1-3UH,CORE 276-0568-00	80009	114-0220-00
L667	114-0222-00	B050000		COIL,RF:2-6UH,CORE 276-0568-00	80009	114-0222-00
L730 [1]						
L731 [1]						
L992	108-0245-00			COIL,RF:3.9UH	80009	108-0245-00
L994	108-0245-00			COIL,RF:3.9UH	80009	108-0245-00
L996	108-0245-00			COIL,RF:3.9UH	80009	108-0245-00
L1229	108-0681-00			COIL,RF:140UH	80009	108-0681-00
L1237	108-0761-00			COIL,RF:1MH	80009	108-0761-00
L1313	108-0679-00			COIL,RF:12UH	80009	108-0679-00
L1316	108-0679-00			COIL,RF:12UH	80009	108-0679-00
L1318	108-0554-00			COIL,RF:5UH	80009	108-0554-00
L1329	108-0646-00			COIL,RF:80UH	80009	108-0646-00
L1352	108-0680-00			COIL,RF:27UH	80009	108-0680-00
L1355	108-0680-00			COIL,RF:27UH	80009	108-0680-00
L1359	108-0646-00			COIL,RF:80UH	80009	108-0646-00
L1363	108-0646-00			COIL,RF:80UH	80009	108-0646-00
L1637	108-0422-00			COIL,RF:82UH	80009	108-0422-00
L1821 [2]	108-0764-00			COIL,RF:FOCUS	80009	108-0764-00
L1903	108-0763-00			COIL,RF:X-Y ALIGNMENT	80009	108-0763-00

[1] Wire coil

[2] Furnished as a unit with CR2205 and L2205

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
L1923	108-0763-00			COIL,RF:X-Y ALIGNMENT	80009	108-0763-00
L1997	108-0395-00			COIL,RF:64UH	80009	108-0395-00
L1999	120-0402-00			XFMR,TOROID:3 TURNS SINGLE	80009	120-0402-00
L2205[1]	108-0764-00			COIL,RF:FOCUS,2.2MH	80009	108-0764-00
L2218	108-0765-00			COIL,RF:70.1UH	80009	108-0765-00
L2219	108-0766-00			COIL,RF:7.07UH	80009	108-0766-00
L2296	108-0200-00	B010100	B010111X	COIL,RF:40UH	80009	108-0200-00
L2390	108-0406-00			COIL,RF:80UH,TOROIDAL	80009	108-0406-00
L2391	108-0406-00			COIL,RF:80UH,TOROIDAL	80009	108-0406-00
L2686	108-0245-00			COIL,RF:3.9UH	80009	108-0245-00
L2701[2]						
L3235	108-0646-00			COIL,RF:80UH	80009	108-0646-00
L3482	108-0331-00			COIL,RF:0.75UH	80009	108-0331-00
LR40	108-0329-00			COIL,RF:2.5UH	80009	108-0329-00
LR780	108-0685-00			COIL,RF:80NH	80009	108-0685-00
LR784	108-0685-00			COIL,RF:80NH	80009	108-0685-00
LR787	108-0330-00			COIL,RF:0.4UH	80009	108-0330-00
LR789	108-0325-00			COIL,RF:0.5UH	80009	108-0325-00
LR791	108-0325-00			COIL,RF:0.5UH	80009	108-0325-00
LR794	108-0325-00			COIL,RF:0.5UH	80009	108-0325-00
LR796	108-0325-00			COIL,RF:0.5UH	80009	108-0325-00
LR798	108-0325-00			COIL,RF:0.5UH	80009	108-0325-00
LR1015	108-0298-00			COIL,RF:0.25UH	80009	108-0298-00
LR1065	108-0298-00			COIL,RF:0.25UH	80009	108-0298-00
LR1119	108-0762-00			COIL,RF:16UH	80009	108-0762-00
LR1139	108-0762-00			COIL,RF:16UH	80009	108-0762-00
LR1169	108-0762-00			COIL,RF:16UH	80009	108-0762-00
LR1189	108-0762-00			COIL,RF:16UH	80009	108-0762-00
LR4521	108-0325-00	XB090000		COIL,RF:0.5UH	80009	108-0325-00
LR4524	108-0325-00	XB090000		COIL,RF:0.5UH	80009	108-0325-00
LR4527	108-0325-00	XB090000		COIL,RF:0.5UH	80009	108-0325-00
LR4531	108-0729-00	XB090000		COIL,RF:210NH	80009	108-0729-00
Q44	151-0199-00			TRANSISTOR:SILICON,PNP	04713	MPS3640
Q52	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q60	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q66	151-0199-00			TRANSISTOR:SILICON,PNP	04713	MPS3640
Q110	151-0199-00			TRANSISTOR:SILICON,PNP	04713	MPS3640
Q142	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q147	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q203	151-0220-00	B010100	B010101	TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q203	151-0221-00	B010102		TRANSISTOR:SILICON,PNP	80009	151-0221-00
Q207	151-0223-00	XB010102		TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q211	151-0327-00	B010100	B010101X	TRANSISTOR:SILICON,PNP	80009	151-0327-00
Q213	151-0223-00	XB010102		TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q215	151-0327-00	B010100	B010101X	TRANSISTOR:SILICON,PNP	80009	151-0327-00
Q220	151-0225-00	B010100	B010101X	TRANSISTOR:SILICON,NPN	07910	CS23365
Q221	151-0282-00	XB010102		TRANSISTOR:SILICON,NPN	02735	2N5179
Q225	151-0225-00	B010100	B010101X	TRANSISTOR:SILICON,NPN	07910	CS23365
Q230	151-0271-00	XB010102		TRANSISTOR:SILICON,PNP	80009	151-0271-00
Q233	151-0271-00	XB010102		TRANSISTOR:SILICON,PNP	80009	151-0271-00
Q250	151-0254-00	XB010202		TRANSISTOR:SILICON,NPN	03508	2N5308
Q252	151-0254-00	XB010202		TRANSISTOR:SILICON,NPN	03508	2N5308

[1]Furnished as a unit with CR2205 and L1821
[2]Part of ckt bd

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Numb
Q273	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q277	151-0221-00			TRANSISTOR:SILICON,PNP	80009	151-0221-00
Q285	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S6075
Q290	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S6075
Q291	151-0301-00	B010100	B0101111	TRANSISTOR:SILICON,PNP	04713	2N2907A
Q291	151-0271-00	B010112		TRANSISTOR:SILICON,PNP	80009	151-0271-00
Q315	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q340	151-0333-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	80009	151-0333-00
Q345	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q350	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q355A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q360A,B	151-1036-00			TRANSISTOR:SILICON,JFE,N-CHANNEL,DUAL	21845	FD1551
Q365	151-0134-00			TRANSISTOR:SILICON,PNP	04713	SM3195
Q370	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q380	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q385	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q405	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q420	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q427	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q430	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q432	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q455	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q460	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q480	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q485	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q490	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q495	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q500	151-1025-00			TRANSISTOR:SILICON,JFE,N-CHANNEL	01295	SBA8129
Q505	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q507	151-0103-00			TRANSISTOR:SILICON,NPN	04713	2N2219A
Q510	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q520	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q525	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q535	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q555	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q570	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q580	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q582	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q616	151-0192-00	B010100	B139999X	TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q617	151-0192-00	B010100	B139999X	TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q694	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q698	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q705	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q710	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q716	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q723	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q728	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q773	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q776	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q785	151-0390-00	XB090000		TRANSISTOR:SILICON,NPN	04713	MPS-U45
Q786	151-0126-00	XB090000		TRANSISTOR:SILICON,NPN	15818	2N2484
Q863	151-0221-00			TRANSISTOR:SILICON,PNP	80009	151-0221-00
Q873	151-0221-00			TRANSISTOR:SILICON,PNP	80009	151-0221-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q887	151-0367-00			TRANSISTOR:SILICON,NPN,SEL FROM 3571TP	80009	151-0367-00
Q889	151-0221-00			TRANSISTOR:SILICON,PNP	80009	151-0221-00
Q897	151-0221-00			TRANSISTOR:SILICON,PNP	80009	151-0221-00
Q899	151-0367-00			TRANSISTOR:SILICON,NPN,SEL FROM 3571TP	80009	151-0367-00
Q901	151-0369-00			TRANSISTOR:SILICON,PNP	01295	SKA6664
Q902	151-0369-00			TRANSISTOR:SILICON,PNP	01295	SKA6664
Q909	151-0424-00			TRANSISTOR:SILICON,NPN	07263	2N5769
Q912	151-0270-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N3495	80009	151-0270-00
Q922	151-0274-00			TRANSISTOR:SILICON,NPN	04713	SS7394
Q925	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q932	151-0274-00			TRANSISTOR:SILICON,NPN	04713	SS7394
Q942	151-0270-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N3495	80009	151-0270-00
Q945	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1010A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1015	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1020A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1025A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1034	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1035	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1044	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1045	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1060A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1065	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1070A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1075A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1084	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1085	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1094	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1095	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1110	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1112	151-0367-00			TRANSISTOR:SILICON,NPN,SEL FROM 3571TP	80009	151-0367-00
Q1114	151-0279-00			TRANSISTOR:SILICON,NPN	80009	151-0279-00
Q1115	151-0280-00			TRANSISTOR:SILICON,PNP	04713	SS8065
Q1123A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1130	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1132	151-0367-00			TRANSISTOR:SILICON,NPN,SEL FROM 3571TP	80009	151-0367-00
Q1134	151-0279-00			TRANSISTOR:SILICON,NPN	80009	151-0279-00
Q1135	151-0280-00			TRANSISTOR:SILICON,PNP	04713	SS8065
Q1143A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1160	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1162	151-0367-00			TRANSISTOR:SILICON,NPN,SEL FROM 3571TP	80009	151-0367-00
Q1164	151-0279-00			TRANSISTOR:SILICON,NPN	80009	151-0279-00
Q1165	151-0280-00			TRANSISTOR:SILICON,PNP	04713	SS8065
Q1173A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1180	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1182	151-0367-00			TRANSISTOR:SILICON,NPN,SEL FROM 3571TP	80009	151-0367-00
Q1184	151-0279-00			TRANSISTOR:SILICON,NPN	80009	151-0279-00
Q1185	151-0280-00			TRANSISTOR:SILICON,PNP	04713	SS8065
Q1193A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1234	151-0368-01			TRANSISTOR:SILICON,NPN	80009	151-0368-01
Q1241	151-0368-01			TRANSISTOR:SILICON,NPN	80009	151-0368-01
Q1246	151-0260-00			TRANSISTOR:SILICON,NPN	04713	2N5859
Q1248	151-0519-00			TRANSISTOR:SILICON,SCR	04713	2N5063

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q1252	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1254	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1409A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1415	151-0292-00			TRANSISTOR:SILICON,NPN	01295	TIS100
Q1418	151-0228-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N4888	80009	151-0228-00
Q1425	151-0136-00			TRANSISTOR:SILICON,NPN	02735	35495
Q1428	151-0349-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE2801	04713	SJE924
Q1436A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1445A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1451	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1455	151-0260-02			TRANSISTOR:SILICON,NPN	04713	2N5859
Q1458	151-0349-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE2801	04713	SJE924
Q1466A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1485	151-0216-00			TRANSISTOR:SILICON,PNP	04713	MPS6523
Q1489A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1496	151-0260-02			TRANSISTOR:SILICON,NPN	04713	2N5859
Q1498	151-0349-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE2801	04713	SJE924
Q1508A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1522	151-0228-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N4888	80009	151-0228-00
Q1526	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1534	151-0136-00			TRANSISTOR:SILICON,NPN	02735	35495
Q1538	151-0349-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE2801	04713	SJE924
Q1560A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1576A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1582	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q1585	151-0260-00			TRANSISTOR:SILICON,NPN	04713	2N5859
Q1588	151-0349-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE2801	04713	SJE924
Q1602	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1634	151-0262-00			TRANSISTOR:SILICON,NPN	02735	62396
Q1636	151-0262-00			TRANSISTOR:SILICON,NPN	02735	62396
Q1672	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q1676	151-0223-00	B010100	B010111X	TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q1678	151-0271-00	B010100	B010111X	TRANSISTOR:SILICON,PNP	80009	151-0271-00
Q1676) Q1678)	153-0623-00	B010112		TRANSISTOR:SILICON,NPN AND PNP MATCHED SET	34335	AM9602DC
Q1682	151-0160-00			TRANSISTOR:SILICON,NPN	07263	S16223
Q1687	151-0134-00			TRANSISTOR:SILICON,PNP	04713	SM3195
Q1689	151-0271-00			TRANSISTOR:SILICON,PNP	80009	151-0271-00
Q1694	151-0124-00			TRANSISTOR:SILICON,NPN,SEL FROM 2N3501	80009	151-0124-00
Q1698	151-0270-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N3495	80009	151-0270-00
Q1711	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q1728	151-0435-00			TRANSISTOR:SILICON,PNP	04713	MPS-A65
Q1736	151-0133-00			TRANSISTOR:SILICON,PNP	80009	151-0133-00
Q1738	151-0347-00			TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q1742	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1748A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1756	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1759	151-0133-00			TRANSISTOR:SILICON,PNP	80009	151-0133-00
Q1763	151-0435-00			TRANSISTOR:SILICON,PNP	04713	MPS-A65
Q1766	151-0133-00			TRANSISTOR:SILICON,PNP	80009	151-0133-00
Q1767	151-0347-00			TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q1774	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q1779	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q1803	151-0292-00	B010100	B010111X	TRANSISTOR:SILICON,NPN	01295	TIS100
Q1814A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q1821	151-0134-00			TRANSISTOR:SILICON,PNP	04713	SM3195
Q1834	151-0279-00			TRANSISTOR:SILICON,NPN	80009	151-0279-00
Q1846	151-0280-00	B010100	B010111X	TRANSISTOR:SILICON,PNP	04713	SS8065
Q1848	151-0280-00	B010100	B010111X	TRANSISTOR:SILICON,PNP	04713	SS8065
Q1853	151-0136-00			TRANSISTOR:SILICON,NPN	02735	35495
Q1878A,B	151-0261-00			TRANSISTOR:SILICON,PNP,DUAL	12040	NS7410
Q1882	151-0347-00			TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q1898	151-0350-00			TRANSISTOR:SILICON,PNP	07263	2N5401
Q1905	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1915	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q1925	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1935	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q1957A,B	151-1071-00			TRANSISTOR:SILICON,JFE,N-CHANNEL,DUAL	17856	DN1120
Q1962	151-0190-01			TRANSISTOR:SILICON,NPN	07910	TE23652
Q1965	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q1968	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q1973	151-0133-00			TRANSISTOR:SILICON,PNP	80009	151-0133-00
Q1991	151-0133-00			TRANSISTOR:SILICON,PNP	80009	151-0133-00
Q2124	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q2129	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q2133	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q2140	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q2164	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q2169	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q2173	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q2215	151-0133-00			TRANSISTOR:SILICON,PNP	80009	151-0133-00
Q2222A,B	151-1041-00			TRANSISTOR:SILICON,FE,N-CHANNEL,DUAL	22229	FD1582
Q2228A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q2232	151-0133-00			TRANSISTOR:SILICON,PNP	80009	151-0133-00
Q2249	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q2255	151-0103-00			TRANSISTOR:SILICON,NPN	04713	2N2219A
Q2289	151-0133-00			TRANSISTOR:SILICON,PNP	80009	151-0133-00
Q2292	151-0221-00			TRANSISTOR:SILICON,PNP	80009	151-0221-00
Q2298	151-0223-00	B010100	B010111X	TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q2302	151-0223-00	B010100	B010111X	TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q2357	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q2360	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q2405	151-0254-00	B010100	B010141X	TRANSISTOR:SILICON,NPN	03508	2N5308
Q2406	151-0188-00	XB010142		TRANSISTOR:SILICON,PNP	01295	2N3906
Q2414	151-0254-00	XB010142		TRANSISTOR:SILICON,NPN	03508	2N5308
Q2443	151-0225-00			TRANSISTOR:SILICON,NPN	07910	CS23365
Q2444	151-0225-00			TRANSISTOR:SILICON,NPN	07910	CS23365
Q2454	151-0221-00			TRANSISTOR:SILICON,PNP	80009	151-0221-00
Q2471	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q2482	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q2484	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q2508	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q2511	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q2514	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q2518	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q2521	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q2525	151-0221-00			TRANSISTOR:SILICON,PNP	80009	151-0221-00
Q2529A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q2535	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q2548	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q2558	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q2562A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q2569	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q2578A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q2585	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q2599	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q2603A,B	151-1041-00			TRANSISTOR:SILICON,FE,N-CHANNEL,DUAL	22229	FD1582
Q2608	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q2613	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q2615	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q2618	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q2623	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q2629A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q2635	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q2648	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q2658	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q2775	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q2780	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q2905	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q3217	151-0260-00			TRANSISTOR:SILICON,NPN	04713	2N5859
Q3220	151-0349-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE2801	04713	SJE924
Q3238	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q3244	151-0216-00			TRANSISTOR:SILICON,PNP	04713	MPS6523
Q3365	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q3375	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q3406A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q3411	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q3414	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q3416	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q3419	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q3427	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q3442	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q3445	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q3486	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q3489	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q3493	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q3499	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q4406A,B[1]	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q4411[1]	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q4414[1]	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q4416[1]	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q4419[1]	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q4427[1]	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q4442[1]	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q4494[1]	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q4497[1]	151-0235-00			TRANSISTOR:SILICON,PNP	04713	2N4890
Q4551	151-0362-00	XB090000		TRANSISTOR:SILICON,PNP,SEL FROM 2N4258	80009	151-0362-00
Q4555	151-0362-00	XB090000		TRANSISTOR:SILICON,PNP,SEL FROM 2N4258	80009	151-0362-00
Q4633	151-0302-00	XB140000		TRANSISTOR:SILICON,NPN	04713	2N2222A

[1]Option 20 only

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q4652	151-0341-00	XB140000		TRANSISTOR:SILICON,NPN	07263	2N3565
R20	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R21	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R23	321-0128-00			RES.,FXD,FILM:210 OHM,1%,0.125W	75042	CEAT0-2100F
R24	321-0296-00			RES.,FXD,FILM:11.8K OHM,1%,0.125W	75042	CEAT0-1182F
R26	321-0220-00			RES.,FXD,FILM:1.91K OHM,1%,0.125W	75042	CEAT0-1911F
R27	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R29	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R34	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R36	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R37	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R39	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R42	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R43	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R45	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R46	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R48	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R49	315-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
R51	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R53	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R54	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R55	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R58	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R60	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R62	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R63	315-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
R64	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R66	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R67	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R69	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R70	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R72	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R74	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R76	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R79	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R80	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R84	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R86	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R91	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R93	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R95	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R96	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R98	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R99	323-0164-00			RES.,FXD,FILM:499 OHM,1%,0.50W	75042	CECT0-4990F
R102	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R103	315-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	01121	CB8225
R106	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R107	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R108	315-0273-00			RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
R110	321-0328-00			RES.,FXD,FILM:25.5K OHM,1%,0.125W	75042	CEAT0-2552F
R112	321-0224-00			RES.,FXD,FILM:2.1K OHM,1%,0.125W	75042	CEAT0-2101F
R115	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F

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R117	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R118	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R120	311-1528-00			RES.,VAR,WW:5K OHM,0.25%,2W	01121	533-9507
R124	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R126	321-0226-00			RES.,FXD,FILM:2.21K OHM,1%,0.125W	75042	CEAT0-2211F
R127	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R128	315-0820-00			RES.,FXD,CMPSN:82 OHM,5%,0.25W	01121	CB8205
R130	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R131	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R134	321-0205-00			RES.,FXD,FILM:1.33K OHM,1%,0.125W	75042	CEAT0-1331F
R137	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R139	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R140	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R142	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R145	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R146	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R147	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R148	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R150	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R152	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R155	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R156	321-0204-00			RES.,FXD,FILM:1.3K OHM,1%,0.125W	75042	CEAT0-1301F
R158	315-0683-00			RES.,FXD,CMPSN:68K OHM,5%,0.25W	01121	CB6835
R159	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R160	315-0334-00			RES.,FXD,CMPSN:330K OHM,5%,0.25W	01121	CB3345
R161	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R163	315-0334-00			RES.,FXD,CMPSN:330K OHM,5%,0.25W	01121	CB3345
R164	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R172	315-0273-00			RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
R173	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R200	315-0240-00	XB010102		RES.,FXD,CMPSN:24 OHM,5%,0.25W	01121	CB2405
R201	315-0562-00	B010100	B010101	RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R201	315-0362-00	B010102		RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R203	315-0102-00	B010100	B010101	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R203	315-0270-00	B010102		RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R205	315-0302-00	B010100	B010101X	RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R206	315-0102-00	B010102		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R207	321-0126-00	B010100	B010101	RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R207	321-0207-00	B010102		RES.,FXD,FILM:1.4K OHM,1%,0.125W	75042	CEAT0-1401F
R208	321-0698-00	B010100	B010101	RES.,FXD,FILM:1.89K OHM,0.25%,0.125W	07716	CEAE-18900C
R208	321-0239-00	B010102		RES.,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F
R209	321-0248-00	B010100	B010101	RES.,FXD,FILM:3.74K OHM,1%,0.125W	75042	CEAT0-3741F
R209	321-0261-00	B010102		RES.,FXD,FILM:5.11K OHM,1%,0.125W	75042	CEAT0-5111F
R211	315-0201-00	B010100	B010101	RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R211	315-0100-00	B010102		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R212	321-0321-07	B010100	B010101	RES.,FXD,FILM:21.5K OHM,0.1%,0.125W	91637	MFF1816C21501B
R212	315-0471-00	B010102		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R213	315-0201-00	XB010102		RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R214	315-0201-00	B010100	B010101X	RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R215	321-0273-00	XB010102		RES.,FXD,FILM:6.81K OHM,1%,0.125W	75042	CEAT0-6811F
R216	321-0321-07	B010100	B010101	RES.,FXD,FILM:21.5K OHM,0.1%,0.125W	91637	MFF1816C21501B
R216	315-0100-00	B010102		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R218	315-0432-00	B010100	B010101	RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325

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R218	315-0242-00	B010102		RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R219	315-0102-00	B010100	B010101	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R219	315-0100-00	B010102		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R221	301-0122-00	B010100	B010101	RES.,FXD,CMPSN:1.2K OHM,5%,0.50W	01121	EB1225
R221	315-0102-00	B010102		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R222	321-0297-00	B010100	B010101	RES.,FXD,FILM:12.1K OHM,1%,0.125W	75042	CEAT0-1212F
R222	315-0202-00	B010102		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R223	315-0100-00	XB010102		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R224	317-0181-00	B010100	B010101	RES.,FXD,CMPSN:180 OHM,5%,0.125W	01121	BB1815
R224	315-0101-00	B010102		RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R225	315-0911-00	B010100	B010101	RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R225	315-0202-00	B010102		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R227	317-0430-00	B010100	B010101	RES.,FXD,CMPSN:43 OHM,5%,0.125W	01121	BB4305
R227	315-0331-00	B010102		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R228	311-1564-00	B010100	B010101X	RES.,VAR,NONWIR:500 OHM,20%,0.50W	73138	91A-500R0M
R229	315-0510-00	XB010102		RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R230	311-1260-00	B010100	B010101X	RES.,VAR,NONWIR:250 OHM,10%,0.50W	73138	62PT-345-0
R231	315-0101-00	XB010102		RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R232	323-0801-07	B010100	B010101	RES.,FXD,FILM:2.775K OHM,0.1%,0.50W	91637	MFF1226C27750B
R232	311-1261-00	B010102		RES.,VAR,NONWIR:500 OHM,10%,0.50W	80294	3329P-L58-501
R233	321-1000-07	B010100	B010101	RES.,FXD,FILM:21.1K OHM,0.1%,0.125W	91637	MFF1816C21101B
R233	323-0257-00	B010102	B010111	RES.,FXD,FILM:4.64K OHM,1%,0.50W	75042	CECT0-4641F
R233	323-0257-09	B010112		RES.,FXD,FILM:4.64K OHM,1%,0.50W	91637	MFF1226C46400F
R235	321-1600-07	B010100	B010101	RES.,FXD,FILM:1.851K OHM,0.1%,0.125W	91637	MFF181C18510B
R235	315-0270-00	B010102		RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R236	315-0911-00	XB010102		RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R237	323-0801-07	B010100	B010101	RES.,FXD,FILM:21.1K OHM,0.1%,0.50W	91637	MFF1226C27750B
R237	311-1259-00	B010102		RES.,VAR,NONWIR:100 OHM,10%,0.50W	80294	3329P-L58-101
R238	315-0431-00	B010102		RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R239	321-0961-07	B010100	B010101X	RES.,FXD,FILM:500.5 OHM,0.1%,0.125W	91637	MFF1816C500R5B
R240	321-0749-06	XB010102		RES.,FXD,FILM:450 OHM,0.25%,0.125W	75042	CEAT9-4500C
R241	315-0100-00	B010100	B010101	RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R241	315-0620-00	B010102		RES.,FXD,CMPSN:62 OHM,5%,0.25W	01121	CB6205
R243	321-0773-03	XB010102	B010111	RES.,FXD,FILM:400 OHM,0.25%,0.125W	75042	CEAT2-4000C
R243	321-1629-04	B010112		RES.,FXD,FILM:405 OHM,0.1%,0.125W	91637	MFF1816D405R0B
R244	315-0220-00	B010100	B010101X	RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R245	321-0751-06	XB010102		RES.,FXD,FILM:50 OHM,0.25%,0.125W	75042	CEAT9-50R00C
R246	315-0100-00	B010100	B010101	RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R246	317-0047-00	B010102		RES.,FXD,CMPSN:4.7 OHM,5%,0.125W	01121	BB4R705
R247	315-0150-00	B010100	B010101X	RES.,FXD,CMPSN:15 OHM,5%,0.25W	01121	CB1505
R250	315-0103-00	XB010202		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R251	301-0432-00	B010100	B129999X	RES.,FXD,CMPSN:4.3K OHM,5%,0.50W	01121	EB4325
R251	301-0202-00	B130000		RES.,FXD,CMPSN:2K OHM,5%,0.50W	01121	CB2025
R252	315-0103-00	XB010202		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R254	315-0103-00	XB010202		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R255	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R259[1]	311-1578-00			RES.,VAR,NONWIR:25 X 25K OHM,2%,0.50W	01121	11M706
R261	301-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.50W	01121	EB1035
R262	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R263	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R264	315-0123-00	B010100	B010111	RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R264	311-1246-00	B010112		RES.,VAR,NONWIR:50K OHM,10%,0.5W	73138	72X-31-0-503K
R265	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005

[1]Furnished as a unit with R2450 and S259

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R266	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R268	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R269	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R271	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R272	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R274	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R275	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R277	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R278	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R279	321-0143-00	B010100	B010111	RES.,FXD,FILM:301 OHM,1%,0.125W	75042	CEAT0-3010F
R279	321-0140-00	B010112		RES.,FXD,FILM:280 OHM,1%,0.125W	75042	CEAT0-2800F
R281	321-0162-00			RES.,FXD,FILM:475 OHM,1%,0.125W	75042	CEAT0-4750F
R283	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R284	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R285	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R286	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R287	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R289	301-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.50W	01121	EB1025
R291	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R292	321-0180-00	B010100	B010111	RES.,FXD,FILM:732 OHM,1%,0.125W	75042	CEAT0-7320F
R292	321-0177-00	B010112		RES.,FXD,FILM:681 OHM,1%,0.125W	75042	CEAT0-6810F
R293	321-0226-00			RES.,FXD,FILM:2.21K OHM,1%,0.125W	75042	CEAT0-2211F
R295	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R296	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R297	321-0191-00			RES.,FXD,FILM:953 OHM,1%,0.125W	75042	CEAT0-9530F
R302	321-0440-00	B010100	B010111	RES.,FXD,FILM:374K OHM,1%,0.125W	75042	CEAT0-3743F
R302	321-0439-00	B010112		RES.,FXD,FILM:365K OHM,1%,0.125W	75042	CEAT0-3653F
R304	321-0244-00	B010100	B010111	RES.,FXD,FILM:3.4K OHM,1%,0.125W	75042	CEAT0-3401F
R304	321-0241-00	B010112		RES.,FXD,FILM:3.16K OHM,1%,0.125W	75042	CEAT0-3161F
R306	321-0442-00			RES.,FXD,FILM:392K OHM,1%,0.125W	75042	CEAT0-3923F
R307	321-0212-00	B010100	B010111	RES.,FXD,FILM:1.58K OHM,1%,0.125W	75042	CEAT0-1581F
R307	321-0214-00	B010112		RES.,FXD,FILM:1.65K OHM,1%,0.125W	75042	CEAT0-1651F
R309	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R312	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R313	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R314	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R316	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R317	315-0133-00			RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
R320	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R321	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R322	311-1238-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	72X-27-0.502K
R324	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R326	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R328	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R329	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R331	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R333	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R334	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R335	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R336	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R337	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R339	315-0150-00			RES.,FXD,CMPSN:15 OHM,5%,0.25W	01121	CB1505
R341	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015

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R342	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R343	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R345	321-0420-00			RES.,FXD,FILM:232K OHM,1%,0.125W	75042	CEAT0-2323F
R346	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	75042	CEAT0-4021F
R347	321-0309-00			RES.,FXD,FILM:16.2K OHM,1%,0.125W	75042	CEAT0-1622F
R349	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R352	321-0496-00			RES.,FXD,FILM:1.43M OHM,1%,0.125W	91637	HMF188G14303F
R354	323-0540-00			RES.,FXD,FILM:4.12M OHM,1%,0.50W	91637	HMF129G41203F
R357	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R359	311-1248-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	73138	72X-23-0-501K
R360	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R362	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R363	301-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.5W	01121	EB3625
R365	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R366	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R367	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R369	321-0244-00			RES.,FXD,FILM:3.4K OHM,1%,0.125W	75042	CEAT0-3401F
R370	321-0232-00			RES.,FXD,FILM:2.55K OHM,1%,0.125W	75042	CEAT0-2551F
R371	321-0264-00			RES.,FXD,FILM:5.49K OHM,1%,0.125W	75042	CEAT0-5491F
R373	322-0193-00			RES.,FXD,FILM:1K OHM,1%,0.25W	75042	CEBT0-1001F
R374	321-0070-00			RES.,FXD,FILM:52.3 OHM,1%,0.125W	75042	CEAT0-52R30F
R376	321-0122-00			RES.,FXD,FILM:182 OHM,1%,0.125W	75042	CEAT0-1820F
R378	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R379	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R381	321-0105-00			RES.,FXD,FILM:121 OHM,1%,0.125W	75042	CEAT0-1210F
R383	321-0122-00			RES.,FXD,FILM:182 OHM,1%,0.125W	75042	CEAT0-1820F
R384	321-0218-00			RES.,FXD,FILM:1.82K OHM,1%,0.125W	75042	CEAT0-1821F
R385	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	75042	CEAT0-3651F
R387	322-0193-00			RES.,FXD,FILM:1K OHM,1%,0.25W	75042	CEBT0-1001F
R388	321-0070-00			RES.,FXD,FILM:52.3 OHM,1%,0.125W	75042	CEAT0-52R30F
R391	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R392	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R394	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R395	322-0327-03			RES.,FXD,FILM:24.9K OHM,0.25%,0.25W	91637	MFF1421D24901C
R397	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R398	321-0202-00			RES.,FXD,FILM:1.24K OHM,1%,0.125W	75042	CEAT0-1241F
R399	321-0260-03			RES.,FXD,FILM:4.99K OHM,0.25%,0.125W	91637	MFF1816D49900C
R400	321-0277-03			RES.,FXD,FILM:7.5K OHM,0.25%,0.125W	91637	MFF1816D75000C
R402	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R404	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R405	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R406	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R408	321-0278-00			RES.,FXD,FILM:7.68K OHM,1%,0.125W	75042	CEAT0-7681F
R410	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R412	321-0293-00			RES.,FXD,FILM:11K OHM,1%,0.125W	75042	CEAT0-1102F
R413	315-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	01121	CB8225
R414	321-0260-03			RES.,FXD,FILM:4.99K OHM,0.25%,0.125W	91637	MFF1816D49900C
R415	321-0327-03			RES.,FXD,FILM:24.9K OHM,0.25%,0.125W	91637	MFF1421D24901C
R417	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R419	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R420	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R421	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R422	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025

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R424	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R425	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R426	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R428	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R431	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R433	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R434	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R442	321-0422-00			RES.,FXD,FILM:243K OHM,1%,0.125W	75042	CEAT0-2433F
R444	321-0244-00	B010100	B010111	RES.,FXD,FILM:3.4K OHM,1%,0.125W	75042	CEAT0-3401F
R444	321-0241-00	B010112		RES.,FXD,FILM:3.16K OHM,1%,0.125W	75042	CEAT0-3161F
R446	321-0425-00			RES.,FXD,FILM:261K OHM,1%,0.125W	75042	CEAT0-2613F
R447	321-0212-00	B010100	B010111	RES.,FXD,FILM:1.58K OHM,1%,0.125W	75042	CEAT0-1581F
R447	321-0214-00	B010112		RES.,FXD,FILM:1.65K OHM,1%,0.125W	75042	CEAT0-1651F
R449	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R451	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R456	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R458	315-0103-00	B010100	B129999	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R458	315-0822-00	B130000		RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	01121	CB8225
R460	315-0103-00	B010100	B010116	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R460	315-0562-00	B010117	B129999	RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R460	315-0682-00	B130000		RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R462	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R463	315-0133-00			RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
R465	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R466	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R468	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R469	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R471	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R472	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R473	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R474	315-0273-00			RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
R475	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R477	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R479	321-0445-00	B010100	B010116	RES.,FXD,FILM:422K OHM,1%,0.125W	75042	CEAT0-4223F
R479	321-0375-00	B010117		RES.,FXD,FILM:78.7K OHM,1%,0.125W	75042	CEAT0-7872F
R480	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R482	321-0431-00			RES.,FXD,FILM:301K OHM,1%,0.125W	75042	CEAT0-3013F
R483	321-0361-00			RES.,FXD,FILM:56.2K OHM,1%,0.125W	75042	CEAT0-5622F
R485	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R487	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R489	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R490	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R492	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R493	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R494	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R496	315-0113-00			RES.,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
R497	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	01121	CB2245
R499	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R501	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R503	301-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.50W	01121	EB1035
R506	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R507	315-0750-00			RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R509	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005

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R511	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R512	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R514	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R515	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R516	321-0241-00			RES.,FXD,FILM:3.16K OHM,1%,0.125W	75042	CEAT0-3161F
R517	321-0234-00			RES.,FXD,FILM:2.67K OHM,1%,0.125W	75042	CEAT0-2671F
R518	321-0286-00			RES.,FXD,FILM:9.31K OHM,1%,0.125W	75042	CEAT0-9311F
R520	322-0193-00			RES.,FXD,FILM:1K OHM,1%,0.25W	75042	CEBT0-1001F
R521	321-0070-00			RES.,FXD,FILM:52.3 OHM,1%,0.125W	75042	CEAT0-52R30F
R523	321-0122-00			RES.,FXD,FILM:182 OHM,1%,0.125W	75042	CEAT0-1820F
R525	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R526	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R528	321-0105-00			RES.,FXD,FILM:121 OHM,1%,0.125W	75042	CEAT0-1210F
R530	321-0122-00			RES.,FXD,FILM:182 OHM,1%,0.125W	75042	CEAT0-1820F
R532	321-0218-00			RES.,FXD,FILM:1.82K OHM,1%,0.125W	75042	CEAT0-1821F
R533	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	75042	CEAT0-3651F
R536	322-0193-00			RES.,FXD,FILM:1K OHM,1%,0.25W	75042	CEBT0-1001F
R537	321-0070-00			RES.,FXD,FILM:52.3 OHM,1%,0.125W	75042	CEAT0-52R30F
R540	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R541	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R543	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R544	322-0327-03			RES.,FXD,FILM:24.9K OHM,0.25%,0.25W	91637	MFF1421D24901C
R546	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R548	321-0202-00			RES.,FXD,FILM:1.24K OHM,1%,0.125W	75042	CEAT0-1241F
R549	321-0260-03			RES.,FXD,FILM:4.99K OHM,0.25%,0.125W	91637	MFF1816D49900C
R550	321-0277-03			RES.,FXD,FILM:7.5K OHM,0.25%,0.125W	91637	MFF1816D75000C
R552	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R554	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R555	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R556	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R558	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R560	321-0278-00			RES.,FXD,FILM:7.68K OHM,1%,0.125W	75042	CEAT0-7681F
R562	321-0293-00			RES.,FXD,FILM:11K OHM,1%,0.125W	75042	CEAT0-1102F
R563	315-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	01121	CB8225
R564	321-0260-03			RES.,FXD,FILM:4.99K OHM,0.25%,0.125W	91637	MFF1816D49900C
R565	321-0327-03			RES.,FXD,FILM:24.9K OHM,0.25%,0.125W	91637	MFF1421D24901C
R567	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R569	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R570	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R571	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R572	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R574	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R575	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R576	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R578	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R581	321-0219-00	B010100	B129999	RES.,FXD,FILM:1.87K OHM,1%,0.125W	75042	CEAT0-1871F
R581	321-0217-00	B130000		RES.,FXD,FILM:1.78K OHM,1%,0.125W	75042	CEAT0-1781F
R583	321-0143-00			RES.,FXD,FILM:301 OHM,1%,0.125W	75042	CEAT0-3010F
R584	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R589	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R590	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R591	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R592	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005

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R594	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R595	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R597	315-0273-00			RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
R598	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R599	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R602	SELECTED	B010100	B139999X			
R603	325-0044-00	B010100	B139999X	RES.,FXD,FILM:100 OHM,0.5%,0.05W	03888	PME50T1-1000D
R605	SELECTED	B010100	B139999X			
R606	325-0044-00	B010100	B139999X	RES.,FXD,FILM:100 OHM,0.5%,0.05W	03888	PME50T1-1000D
R608	SELECTED	B010100	B139999X			
R609	325-0044-00	B010100	B139999X	RES.,FXD,FILM:100 OHM,0.5%,0.05W	03888	PME50T1-1000D
R611	SELECTED	B010100	B139999X			
R612	325-0044-00	B010100	B139999X	RES.,FXD,FILM:100 OHM,0.5%,0.05W	03888	PME50T1-1000D
R613	321-0150-00	B010100	B139999X	RES.,FXD,FILM:357 OHM,1%,0.125W	75042	CEAT0-3570F
R614	321-0120-00	B010100	B139999X	RES.,FXD,FILM:174 OHM,1%,0.125W	75042	CEAT0-1740F
R615	321-0147-00	B010100	B139999X	RES.,FXD,FILM:332 OHM,1%,0.125W	75042	CEAT0-3320F
R616	321-0210-00	B010100	B139999X	RES.,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R618	315-0302-00	B010100	B139999X	RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R619	322-0189-00	B010100	B139999X	RES.,FXD,FILM:909 OHM,1%,0.25W	75042	CEBT0-9090F
R620	315-0102-00	B010100	B139999X	RES.,FXD,CMPSN:1K OHM,(NOM VALUE),SEL	01121	CB1025
R621	321-0133-00	B010100	B139999X	RES.,FXD,FILM:237 OHM,1%,0.125W	75042	CEAT0-2370F
R622	SELECTED	B010100	B139999X			
R623	315-0431-00	B010100	B139999X	RES.,FXD,CMPSN:430 OHM,(NOM VALUE),SEL	01121	CB4315
R624	321-0133-00	B010100	B139999X	RES.,FXD,FILM:237 OHM,1%,0.125W	75042	CEAT0-2370F
R625	323-0131-00	B010100	B139999X	RES.,FXD,FILM:226 OHM,1%,0.50W	75042	CECT0-2260F
R626	315-0751-00	B010100	B139999X	RES.,FXD,CMPSN:750 OHM,(NOM VALUE),SEL	01121	CB7515
R627	321-0133-00	B010100	B139999X	RES.,FXD,FILM:237 OHM,1%,0.125W	75042	CEAT0-2370F
R628	SELECTED	B010100	B139999X			
R629	315-0911-00	B010100	B139999X	RES.,FXD,CMPSN:910 OHM,(NOM VALUE),SEL	01121	CB9115
R630	321-0133-00	B010100	B139999X	RES.,FXD,FILM:237 OHM,1%,0.125W	75042	CEAT0-2370F
R631	323-0131-00	B010100	B139999X	RES.,FXD,FILM:226 OHM,1%,0.50W	75042	CECT0-2260F
R632	315-0751-00	B010100	B139999X	RES.,FXD,CMPSN:750 OHM,(NOM VALUE),SEL	01121	CB7515
R633	321-0133-00	B010100	B139999X	RES.,FXD,FILM:237 OHM,1%,0.125W	75042	CEAT0-2370F
R634	SELECTED	B010100	B139999X			
R635	315-0911-00	B010100	B139999X	RES.,FXD,CMPSN:910 OHM,(NOM VALUE),SEL	01121	CB9115
R636	321-0133-00	B010100	B139999X	RES.,FXD,FILM:237 OHM,1%,0.125W	75042	CEAT0-2370F
R637	323-0131-00	B010100	B139999X	RES.,FXD,FILM:226 OHM,1%,0.50W	75042	CECT0-2260F
R638	315-0102-00	B010100	B139999X	RES.,FXD,CMPSN:1K OHM,(NOM VALUE),SEL	01121	CB1025
R639	321-0133-00	B010100	B139999X	RES.,FXD,FILM:237 OHM,1%,0.125W	75042	CEAT0-2370F
R640	SELECTED	B010100	B139999X			
R641	315-0431-00	B010100	B139999X	RES.,FXD,CMPSN:430 OHM,(NOM VALUE),SEL	01121	CB4315
R642	321-0133-00	B010100	B139999X	RES.,FXD,FILM:237 OHM,1%,0.125W	75042	CEAT0-2370F
R643	323-0131-00	B010100	B139999X	RES.,FXD,FILM:226 OHM,1%,0.50W	75042	CECT0-2260F
R644	317-0101-00	XB010160		RES.,FXD,CMPSN:100 OHM,(NOM VALUE),SEL	01121	BB1015
R646	SELECTED	B010100	B139999X			
R657	317-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.125W	01121	BB2705
R658	311-0605-01			RES.,VAR,NONWIR:200 OHM,10%,0.50W	73138	82P-3-0-201
R659	317-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.125W	01121	BB2705
R660	324-0114-00			RES.,FXD,FILM:150 OHM,1%,1W	91637	MFF1226G1500F
R661	324-0114-00			RES.,FXD,FILM:150 OHM,1%,1W	91637	MFF1226G1500F
R662	321-0039-00			RES.,FXD,FILM:24.9 OHM,1%,0.125W	75042	CEAT0-24R90F
R663	321-0039-00			RES.,FXD,FILM:24.9 OHM,1%,0.125W	75042	CEAT0-24R90F
R667	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615

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R668	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R670	317-0047-00			RES.,FXD,CMPSN:4.7 OHM,5%,0.125W	01121	BB4R705
R672	317-0047-00			RES.,FXD,CMPSN:4.7 OHM,5%,0.125W	01121	BB4R705
R676	317-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
R677	323-0069-00			RES.,FXD,FILM:51.1 OHM,1%,0.50W	75042	CECT0-51R10F
R679	323-0069-00			RES.,FXD,FILM:51.1 OHM,1%,0.50W	75042	CECT0-51R10F
R680	317-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
R682	323-0121-00			RES.,FXD,FILM:178 OHM,1%,0.50W	75042	CECT0-1780F
R684	SELECTED					
R685	315-0820-00			RES.,FXD,CMPSN:82 OHM,5%,0.25W	01121	CB8205
R686	315-0820-00			RES.,FXD,CMPSN:82 OHM,5%,0.25W	01121	CB8205
R688	SELECTED					
R689	323-0121-00			RES.,FXD,FILM:178 OHM,1%,0.50W	75042	CECT0-1780F
R691	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R693	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R694	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R695	321-0058-00			RES.,FXD,FILM:39.2 OHM,1%,0.125W	75042	CEAT0-39R20F
R697	321-0058-00			RES.,FXD,FILM:39.2 OHM,1%,0.125W	75042	CEAT0-39R20F
R698	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R700	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R701	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R703	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R704	315-0621-00			RES.,FXD,CMPSN:620 OHM,5%,0.25W	01121	CB6215
R706	321-0237-00			RES.,FXD,FILM:2.87K OHM,1%,0.125W	75042	CEAT0-2871F
R707	311-1259-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	80294	3329P-L58-101
R708	321-0114-00			RES.,FXD,FILM:150 OHM,1%,0.125W	75042	CEAT0-1500F
R709	321-0114-00			RES.,FXD,FILM:150 OHM,1%,0.125W	75042	CEAT0-1500F
R711	321-0201-00			RES.,FXD,FILM:1.21K OHM,1%,0.125W	75042	CEAT0-1211F
R712	311-0532-00			RES.,VAR,WW:1.5K OHM,5%,1W	80294	3345P-1-152
R713	321-0201-00			RES.,FXD,FILM:1.21K OHM,1%,0.125W	75042	CEAT0-1211F
R715	321-0123-00			RES.,FXD,FILM:187 OHM,1%,0.125W	75042	CEAT0-1870F
R717	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R718	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R719	321-0191-00			RES.,FXD,FILM:953 OHM,1%,0.125W	75042	CEAT0-9530F
R721	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R722	321-0117-00			RES.,FXD,FILM:162 OHM,1%,0.125W	75042	CEAT0-1620F
R724	323-0164-00			RES.,FXD,FILM:499 OHM,1%,0.50W	75042	CECT0-4990F
R725	323-0164-00			RES.,FXD,FILM:499 OHM,1%,0.50W	75042	CECT0-4990F
R727	321-0055-00			RES.,FXD,FILM:36.5 OHM,1%,0.125W	75042	CEAT0-36R50F
R730	311-0622-01			RES.,VAR,NONWIR:100 OHM,10%,0.50W	80294	3329HH76-101
R732	317-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.125W	01121	BB4705
R733	317-0470-00	XB050000		RES.,FXD,CMPSN:47 OHM,5%,0.125W	01121	BB4705
R734	317-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
R735	323-0069-00			RES.,FXD,FILM:51.1 OHM,1%,0.50W	75042	CECT0-51R10F
R736	317-0101-00	XB050000		RES.,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
R737	323-0069-00			RES.,FXD,FILM:51.1 OHM,1%,0.50W	75042	CECT0-51R10F
R738	317-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
R741	SELECTED					
R743	311-1261-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	80294	3329P-L58-501
R745	315-0561-00			RES.,FXD,CMPSN:560(NOM VALUE),SEL	01121	CB5615
R747	315-0471-00			RES.,FXD,CMPSN:470(NOM VALUE),SEL	01121	CB4715
R749	311-0635-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	80740	62-56-3
R753	323-0097-00			RES.,FXD,FILM:100 OHM,1%,0.50W	75042	CECT0-1000F

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R754	323-0097-00			RES.,FXD,FILM:100 OHM,1%,0.50W	75042	CECT0-1000F
R756	SELECTED					
R758	311-1261-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	80294	3329P-L58-501
R760	315-0751-00			RES.,FXD,CMPSN:750(NOM VALUE),SEL	01121	CB7515
R762	315-0471-00			RES.,FXD,CMPSN:470(NOM VALUE),SEL	01121	CB4715
R764	311-1265-00			RES.,VAR,NONWIR:2K OHM,10%,0.50W	80294	3329P-L58-202
R767	323-0097-00			RES.,FXD,FILM:100 OHM,1%,0.50W	75042	CECT0-1000F
R768	323-0097-00			RES.,FXD,FILM:100 OHM,1%,0.50W	75042	CECT0-1000F
R770	308-0692-00			RES.,FXD,WW:44 OHM,1%,3W	91637	RS2B-K44R00F
R771	323-0112-00			RES.,FXD,FILM:143 OHM,1%,0.5W,(NOM VALUE),SEL	75042	CECT0-1430F
R775	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R778	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R782A,B	307-0292-00	B010100	B010141	RES.,FXD,FILM:182.5 OHM	80009	307-0292-00
R782A,B[1]	307-0292-XX	B010142		RES.,FXD,FILM:182.5 OHM	80009	307-0292-XX
R783	321-0324-00	XB090000		RES.,FXD,FILM:23.2K OHM,1%,0.125W	75042	CEAT0-2322F
R784	321-0289-00	XB090000		RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R785	315-0472-00	XB090000		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R786	315-0362-00	XB090000		RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R788	315-0103-00	XB060000	B089999X	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R790	323-0064-00			RES.,FXD,FILM:45.3 OHM,1%,0.50W	91637	MFF1226G45R30F
R792	323-0064-00			RES.,FXD,FILM:45.3 OHM,1%,0.50W	91637	MFF1226G45R30F
R795	323-0077-00			RES.,FXD,FILM:61.9 OHM,1%,0.50W	75042	CECT0-61R90F
R796	323-0143-00			RES.,FXD,FILM:301 OHM,1%,0.50W	75042	CECT0-3010F
R797	321-0063-00			RES.,FXD,FILM:44.2 OHM,1%,0.125W	75042	CEAT0-44R2F
R799	308-0248-00			RES.,FXD,WW:150 OHM,1%,5W	91637	RS2A-B150R0F
R821	321-1068-01			RES.,FXD,FILM:50.5 OHM,0.5%,0.125W	75042	CEAT0-50R50D
R823	321-1068-01			RES.,FXD,FILM:50.5 OHM,0.5%,0.125W	75042	CEAT0-50R50D
R825	321-1068-01			RES.,FXD,FILM:50.5 OHM,0.5%,0.125W	75042	CEAT0-50R50D
R827	321-1068-01			RES.,FXD,FILM:50.5 OHM,0.5%,0.125W	75042	CEAT0-50R50D
R828	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R829	315-0273-00			RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
R831	321-0088-00			RES.,FXD,FILM:80.6 OHM,1%,0.125W	75042	CEAT0-80R60F
R833	321-0088-00			RES.,FXD,FILM:80.6 OHM,1%,0.125W	75042	CEAT0-80R60F
R835	323-0187-00			RES.,FXD,FILM:866 OHM,1%,0.50W	75042	CECT0-8660F
R838	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R839	321-0218-00			RES.,FXD,FILM:1.82K OHM,1%,0.125W	75042	CEAT0-1821F
R841	323-0187-00			RES.,FXD,FILM:866 OHM,1%,0.50W	75042	CECT0-8660F
R844	321-0088-00			RES.,FXD,FILM:80.6 OHM,1%,0.125W	75042	CEAT0-80R60F
R846	321-0088-00			RES.,FXD,FILM:80.6 OHM,1%,0.125W	75042	CEAT0-80R60F
R850	321-0257-00			RES.,FXD,FILM:4.64K OHM,1%,0.125W	75042	CEAT0-4641F
R851	321-0207-00			RES.,FXD,FILM:1.4K OHM,1%,0.125W	75042	CEAT0-1401F
R853	321-0073-00			RES.,FXD,FILM:56.2 OHM,1%,0.125W	75042	CEAT0-56R20F
R854	322-0187-00			RES.,FXD,FILM:866 OHM,1%,0.25W	75042	CEBT0-8660F
R855	321-0216-00			RES.,FXD,FILM:1.74K OHM,1%,0.125W	75042	CEAT0-1741F
R856	321-0076-00			RES.,FXD,FILM:60.4 OHM,1%,0.125W	75042	CEAT0-60R40F
R858	321-0151-00			RES.,FXD,FILM:365 OHM,1%,0.125W	75042	CEAT0-3650F
R859	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R860	322-0212-00			RES.,FXD,FILM:1.58K OHM,1%,0.25W	75042	CEBT0-1581F
R861	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R862	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R864	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R865	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R866	323-0175-00			RES.,FXD,FILM:649 OHM,1%,0.50W	75042	CECT0-6490F

[1]Thick film Hybrid resistors are part of the CRT Assembly and are selected at the factory to match the impedance of the CRT Vertical Deflection Plates. Order the Tektronix part number printed on the resistors.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R867	321-0127-00			RES.,FXD,FILM:205 OHM,1%,0.125W	75042	CEAT0-2050F
R868	311-1221-00			RES.,VAR,NONWIR:50 OHM,20%,0.50W	80294	3386F-T04-500
R869	321-0127-00			RES.,FXD,FILM:205 OHM,1%,0.125W	75042	CEAT0-2050F
R870	311-0635-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	80740	62-56-3
R871	321-0101-00			RES.,FXD,FILM:110 OHM,1%,0.125W	75042	CEAT0-1100F
R872	311-1259-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	80294	3329P-L58-101
R873	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R874	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R875	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R876	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R878	321-0237-00			RES.,FXD,FILM:2.87K OHM,1%,0.125W	75042	CEAT0-2871F
R879	321-0237-00			RES.,FXD,FILM:2.87K OHM,1%,0.125W	75042	CEAT0-2871F
R883	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R884	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R885	322-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.25W	75042	CEBT0-1501F
R887	301-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.50W	01121	EB1035
R888	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R889	306-0332-00			RES.,FXD,CMPSN:3.3K OHM,10%,2W	01121	HB3321
R893	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R894	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R895	322-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.25W	75042	CEBT0-1501F
R897	301-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.50W	01121	EB1035
R898	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R899	306-0332-00			RES.,FXD,CMPSN:3.3K OHM,10%,2W	01121	HB3321
R901	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R903	315-0162-00			RES.,FXD,CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
R905	301-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.50W	01121	EB8225
R906	311-0643-00			RES.,VAR,NONWIR:50 OHM,10%,0.50W	80740	62-52-3
R907	301-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.50W	01121	EB8225
R908	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R909	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R910	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R912	307-0109-00			RES.,FXD,CMPSN:8.2 OHM,5%,0.25W	01121	CB82G5
R913	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R914	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R915	301-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.50W	01121	EB3335
R917	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R920	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R921	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R923	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R924	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R926	322-0356-00	B010100	B039999	RES.,FXD,FILM:49.9K OHM,1%,0.25W	75042	CEBT0-4992F
R926	325-0176-00	B040000		RES.,FXD,FILM:49.9K OHM,1%,0.25W	91637	MFF1421G49901F
R927	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R928	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R929	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R934	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R937	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R940	301-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.50W	01121	EB3335
R941	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R942	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R943	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R944	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005

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R946	322-0356-00	B010100	B039999	RES.,FXD,FILM:49.9K OHM,1%,0.25W	75042	CEBT0-4992F
R946	325-0176-00	B040000		RES.,FXD,FILM:49.9K OHM,1%,0.25W	91637	MFF1421G49901F
R947	321-0339-00			RES.,FXD,FILM:33.2K OHM,1%,0.125W	75042	CEAT0-3322F
R948	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R949	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R990	315-0390-00			RES.,FXD,CMPSN:39 OHM,5%,0.25W	01121	CB3905
R998	315-0390-00			RES.,FXD,CMPSN:39 OHM,5%,0.25W	01121	CB3905
R1000	321-0306-09			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816C15001F
R1001	311-1238-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	72X-27-0.502K
R1002	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R1003	321-0258-09			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816C47500F
R1004	311-1248-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	73138	72X-23-0-501K
R1005	321-0258-09			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816C47500F
R1006	321-0254-09			RES.,FXD,FILM:4.32K OHM,1%,0.125W	91637	MFF1816C43200F
R1007	321-0408-09			RES.,FXD,FILM:174K OHM,1%,0.125W	91637	MFF1816C17402F
R1009	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R1010	321-0327-00			RES.,FXD,FILM:24.9K OHM,1%,0.125W	75042	CEAT0-2492F
R1012	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R1013	321-0352-00			RES.,FXD,FILM:45.3K OHM,1%,0.125W	75042	CEAT0-4532F
R1015	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1017	321-0327-00			RES.,FXD,FILM:24.9K OHM,1%,0.125W	75042	CEAT0-2492F
R1018	321-0201-00			RES.,FXD,FILM:1.21K OHM,1%,0.125W	91637	MFF1816C12100F
R1020	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R1021	321-0313-09			RES.,FXD,FILM:17.8K OHM,1%,0.125W	91637	MFF1816C17801F
R1023	321-0171-09			RES.,FXD,FILM:590 OHM,1%,0.125W	91637	MFF1816C590R0F
R1024	321-0331-09			RES.,FXD,FILM:27.4K OHM,1%,0.125W	75042	CEAT9-2742F
R1025	321-0257-09			RES.,FXD,FILM:4.64K OHM,1%,0.125W	91637	MFF1816C46400F
R1026	321-0291-09			RES.,FXD,FILM:10.5K OHM,1%,0.125W	91637	MFF1816C10501F
R1028	321-0171-09			RES.,FXD,FILM:590 OHM,1%,0.125W	91637	MFF1816C590R0F
R1029	315-0560-00			RES.,FXD,CMPSN:56 OHM,5%,0.25W	01121	CB5605
R1030	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R1031	321-0313-09			RES.,FXD,FILM:17.8K OHM,1%,0.125W	91637	MFF1816C17801F
R1033	321-0296-09			RES.,FXD,FILM:11.8K OHM,1%,0.125W	91637	MFF1816C11801F
R1034	321-0306-09			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816C15001F
R1035	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1036	323-0289-00			RES.,FXD,FILM:10K OHM,1%,0.50W	75042	CECT0-1002F
R1037	311-1238-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	72X-27-0.502K
R1038	321-0261-09			RES.,FXD,FILM:5.11K OHM,1%,0.125W	91637	MFF1816C15001F
R1039	321-0260-09			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816C99001F
R1040	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R1043	321-0292-09			RES.,FXD,FILM:10.7K OHM,1%,0.125W	91637	MFF1816C10701F
R1044	321-0306-09			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816C15001F
R1045	323-0289-00			RES.,FXD,FILM:10K OHM,1%,0.50W	75042	CECT0-1002F
R1046	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1047	321-0295-09			RES.,FXD,FILM:11.5K OHM,1%,0.125W	91637	MFF1816C11501F
R1048	321-0261-09			RES.,FXD,FILM:5.11K OHM,1%,0.125W	91637	MFF1816C15001F
R1049	321-0260-09			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816C99001F
R1050	321-0287-09			RES.,FXD,FILM:9.53K OHM,1%,0.125W	91637	MFF1816C95300F
R1051	311-1238-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	72X-27-0.502K
R1052	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R1053	321-0258-09			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816C47500F
R1054	311-1248-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	73138	72X-23-0-501K
R1055	321-0258-09			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816C47500F

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R1056	321-0254-09			RES.,FXD,FILM:4.32K OHM,1%,0.125W	91637	MFF1816C43200F
R1057	321-0392-09			RES.,FXD,FILM:118K OHM,1%,0.125W	91637	MFF1816C1802F
R1059	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R1060	321-0327-00			RES.,FXD,FILM:24.9K OHM,1%,0.125W	75042	CEAT0-2492F
R1062	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R1063	321-0352-00			RES.,FXD,FILM:45.3K OHM,1%,0.125W	75042	CEAT0-4532F
R1065	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1067	321-0327-00			RES.,FXD,FILM:24.9K OHM,1%,0.125W	75042	CEAT0-2492F
R1068	321-0201-00			RES.,FXD,FILM:1.21K OHM,1%,0.125W	91637	MFF1816C12100F
R1070	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R1071	321-0313-09			RES.,FXD,FILM:17.8K OHM,1%,0.125W	91637	MFF1816C17801F
R1073	321-0171-09			RES.,FXD,FILM:590 OHM,1%,0.125W	91637	MFF1816C590R0F
R1074	321-0331-09			RES.,FXD,FILM:27.4K OHM,1%,0.125W	75042	CEAT9-2742F
R1075	321-0257-09			RES.,FXD,FILM:4.64K OHM,1%,0.125W	91637	MFF1816C46400F
R1076	321-0291-09			RES.,FXD,FILM:10.5K OHM,1%,0.125W	91637	MFF1816C10501F
R1078	321-0171-09			RES.,FXD,FILM:590 OHM,1%,0.125W	91637	MFF1816C590R0F
R1080	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R1081	321-0313-09			RES.,FXD,FILM:17.8K OHM,1%,0.125W	91637	MFF1816C17801F
R1083	321-0296-09			RES.,FXD,FILM:11.8K OHM,1%,0.125W	91637	MFF1816C11801F
R1084	321-0306-09			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816C15001F
R1085	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1086	323-0289-00			RES.,FXD,FILM:10K OHM,1%,0.50W	75042	CECT0-1002F
R1087	311-1238-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	72X-27-0.502K
R1088	321-0289-09			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816C10001F
R1089	321-0263-09			RES.,FXD,FILM:5.36K OHM,1%,0.125W	91637	MFF1816C53600F
R1090	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R1093	321-0292-09			RES.,FXD,FILM:10.7K OHM,1%,0.125W	91637	MFF1816C10701F
R1094	321-0306-09			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816C15001F
R1095	323-0289-00			RES.,FXD,FILM:10K OHM,1%,0.50W	75042	CECT0-1002F
R1096	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1097	321-0289-09			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816C10001F
R1098	321-0289-09			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816C10001F
R1099	321-0263-09			RES.,FXD,FILM:5.36K OHM,1%,0.125W	91637	MFF1816C53600F
R1100	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R1102	321-0222-09			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816C20000F
R1103	321-0155-09			RES.,FXD,FILM:402 OHM,1%,0.125W	91637	MFF1816C402R0F
R1104	321-0191-09			RES.,FXD,FILM:953 OHM,1%,0.125W	91637	MFF1816C953R0F
R1105	311-1248-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	73138	72X-23-0-501K
R1106	321-0222-09			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816C20000F
R1108	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R1110	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R1111	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R1112	301-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.50W	01121	EB8225
R1115	323-0283-00			RES.,FXD,FILM:8.66K OHM,1%,0.50W	75042	CECT0-8661F
R1117	304-0184-00			RES.,FXD,CMPSN:180K OHM,10%,1W	01121	GB1841
R1118	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1120	324-0356-09			RES.,FXD,FILM:49.9K OHM,1%,1W	91637	MFF1-14C49901F
R1121	323-0355-09			RES.,FXD,FILM:48.7K OHM,1%,0.50W	91637	MFF1226C48701F
R1122	323-0355-09			RES.,FXD,FILM:48.7K OHM,1%,0.50W	91637	MFF1226C48701F
R1124	321-0185-09			RES.,FXD,FILM:825 OHM,1%,0.125W	91637	MFF1816C825R0F
R1125	321-0202-09			RES.,FXD,FILM:1.24K OHM,1%,0.125W	91637	MFF1816C12400F
R1127	311-1238-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	72X-27-0.502K
R1129	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005

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R1130	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R1131	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R1132	301-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.50W	01121	EB8225
R1135	323-0283-00			RES.,FXD,FILM:8.66K OHM,1%,0.50W	75042	CECT0-8661F
R1137	304-0184-00			RES.,FXD,CMPSN:180K OHM,10%,1W	01121	GB1841
R1138	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1140	324-0356-09			RES.,FXD,FILM:49.9K OHM,1%,1W	91637	MFF1-14C49901F
R1141	323-0355-09			RES.,FXD,FILM:48.7K OHM,1%,0.50W	91637	MFF1226C48701F
R1142	323-0355-09			RES.,FXD,FILM:48.7K OHM,1%,0.50W	91637	MFF1226C48701F
R1144	321-0185-09			RES.,FXD,FILM:825 OHM,1%,0.125W	91637	MFF1816C825R0F
R1145	321-0202-09			RES.,FXD,FILM:1.24K OHM,1%,0.125W	91637	MFF1816C12400F
R1146	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1147	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1149	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1150	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R1152	321-0222-09			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816C20000F
R1153	321-0155-09			RES.,FXD,FILM:402 OHM,1%,0.125W	91637	MFF1816C402R0F
R1154	321-0191-09			RES.,FXD,FILM:953 OHM,1%,0.125W	91637	MFF1816C953R0F
R1155	311-1248-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	73138	72X-23-0-501K
R1156	321-0222-09			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816C20000F
R1158	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R1160	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R1161	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R1162	301-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.50W	01121	EB8225
R1165	323-0283-00			RES.,FXD,FILM:8.66K OHM,1%,0.50W	75042	CECT0-8661F
R1167	304-0184-00			RES.,FXD,CMPSN:180K OHM,10%,1W	01121	GB1841
R1168	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1170	324-0356-09			RES.,FXD,FILM:49.9K OHM,1%,1W	91637	MFF1-14C9901F
R1171	323-0355-09			RES.,FXD,FILM:48.7K OHM,1%,0.50W	91637	MFF1226C48701F
R1172	323-0355-09			RES.,FXD,FILM:48.7K OHM,1%,0.50W	91637	MFF1226C48701F
R1174	321-0185-09			RES.,FXD,FILM:825 OHM,1%,0.125W	91637	MFF1816C825R0F
R1175	321-0202-09			RES.,FXD,FILM:1.24K OHM,1%,0.125W	91637	MFF1816C12400F
R1179	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1180	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R1181	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R1182	301-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.50W	01121	EB8225
R1185	323-0283-00			RES.,FXD,FILM:8.66K OHM,1%,0.50W	75042	CECT0-8661F
R1187	304-0184-00			RES.,FXD,CMPSN:180K OHM,10%,1W	01121	GB1841
R1188	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1190	324-0356-09			RES.,FXD,FILM:49.9K OHM,1%,1W	91637	MFF1-14C49901F
R1191	323-0355-09			RES.,FXD,FILM:48.7K OHM,1%,0.50W	91637	MFF1226C48701F
R1192	323-0355-09			RES.,FXD,FILM:48.7K OHM,1%,0.50W	91637	MFF1226C48701F
R1194	321-0185-09			RES.,FXD,FILM:825 OHM,1%,0.125W	91637	MFF1816C2825R0F
R1195	321-0202-09			RES.,FXD,FILM:1.24K OHM,1%,0.125W	91637	MFF1816C12400F
R1196	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1197	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1199	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1205	304-0270-00			RES.,FXD,CMPSN:27 OHM,10%,1W	01121	GB2701
R1208	304-0104-00	B010100	B030211	RES.,FXD,CMPSN:100K OHM,10%,1W	01121	GB1041
R1208	304-0333-00	B030212		RES.,FXD,CMPSN:33K OHM,10%,1W	01121	GB3331
R1210	303-0304-00	B010100	B030211	RES.,FXD,CMPSN:300K OHM,5%,1W	01121	GB3045
R1210	303-0683-00	B030212		RES.,FXD,CMPSN:68K OHM,5%,1W	01121	GB6835
R1213	304-0104-00	B010100	B030211	RES.,FXD,CMPSN:100K OHM,10%,1W	01121	GB1041

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R1213	304-0333-00	B030212		RES.,FXD,CMPSN:33K OHM,10%,1W	01121	GB3331
R1219	302-0565-00			RES.,FXD,CMPSN:5.6M OHM,10%,0.50W	01121	EB5651
R1221	304-0154-00			RES.,FXD,CMPSN:150K OHM,10%,1W	01121	GB1541
R1225	316-0471-00			RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
R1231	307-0057-00			RES.,FXD,CMPSN:5.1 OHM,5%,0.50W	01121	EB51G5
R1232	316-0220-00			RES.,FXD,CMPSN:22 OHM,10%,0.25W	01121	CB2201
R1236	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R1239	307-0057-00			RES.,FXD,CMPSN:5.1 OHM,5%,0.50W	01121	EB51G5
R1240	316-0220-00			RES.,FXD,CMPSN:22 OHM,10%,0.25W	01121	CB2201
R1242	315-0753-00	B010100	B030211	RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
R1242	315-0153-00	B030212		RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R1243	315-0274-00			RES.,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
R1244	316-0270-00			RES.,FXD,CMPSN:27 OHM,10%,0.25W	01121	CB2701
R1245	316-0101-00			RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
R1246	316-0561-00			RES.,FXD,CMPSN:560 OHM,10%,0.25W	01121	CB5611
R1247	316-0684-00			RES.,FXD,CMPSN:680K OHM,10%,0.25W	01121	CB6841
R1248	302-0332-00			RES.,FXD,CMPSN:3.3K OHM,10%,0.50W	01121	EB3321
R1249	316-0101-00			RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
R1253	316-0473-00			RES.,FXD,CMPSN:47K OHM,10%,0.25W	01121	CB4731
R1256	316-0562-00			RES.,FXD,CMPSN:5.6K OHM,10%,0.25W	01121	CB5621
R1257	316-0223-00			RES.,FXD,CMPSN:22K OHM,10%,0.25W	01121	CB2231
R1259	316-0562-00			RES.,FXD,CMPSN:5.6K OHM,10%,0.25W	01121	CB5621
R1261	316-0104-00			RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R1267	316-0154-00			RES.,FXD,CMPSN:150K OHM,10%,0.25W	01121	CB1541
R1269	316-0224-00			RES.,FXD,CMPSN:220K OHM,10%,0.25W	01121	CB2241
R1270	316-0123-00	B010100	B010201	RES.,FXD,CMPSN:12K OHM,10%,0.25W	01121	CB1231
R1270	315-0203-00	B010202	B030211	RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R1270	315-0123-00	B030212		RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R1271	315-0431-00	B010100	B030211	RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R1271	315-0201-00	B030212		RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R1272	316-0470-00			RES.,FXD,CMPSN:47 OHM,10%,0.25W	01121	CB4701
R1277	316-0560-00			RES.,FXD,CMPSN:56 OHM,10%,0.25W	01121	CB5601
R1279	316-0181-00			RES.,FXD,CMPSN:180 OHM,10%,0.25W	01121	CB1811
R1284	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R1285	321-0313-00			RES.,FXD,FILM:17.8K OHM,1%,0.125W	75042	CEAT0-1782F
R1286	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1287	321-0001-00			RES.,FXD,FILM:10 OHM,1%,0.125W	75042	CEAT0-10R00F
R1292	321-0425-00			RES.,FXD,FILM:261K OHM,1%,0.125W	75042	CEAT0-2613F
R1293	311-1239-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	73138	72Y-26-0-252K
R1294	321-0283-00			RES.,FXD,FILM:8.66K OHM,1%,0.125W	75042	CEAT0-8661F
R1296	321-0282-00			RES.,FXD,FILM:8.45K OHM,1%,0.125W	75042	CEAT0-8451F
R1297	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1300	321-0366-00			RES.,FXD,FILM:63.4K OHM,1%,0.125W	75042	CEAT0-6342F
R1301	316-0153-00			RES.,FXD,CMPSN:15K OHM,10%,0.25W	01121	CB1531
R1302	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R1304	321-0286-00			RES.,FXD,FILM:9.31K OHM,1%,0.125W	75042	CEAT0-9311F
R1305	321-0339-00			RES.,FXD,FILM:33.2K OHM,1%,0.125W	75042	CEAT0-3322F
R1326	301-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.50W	01121	EB5635
R1401	316-0471-00			RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
R1402	316-0221-00			RES.,FXD,CMPSN:220 OHM,10%,0.25W	01121	CB2211
R1404	316-0474-00			RES.,FXD,CMPSN:470K OHM,10%,0.25W	01121	CB4741
R1406	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R1408	316-0274-00			RES.,FXD,CMPSN:270K OHM,10%,0.25W	01121	CB2741

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R1412	321-0924-07			RES.,FXD,FILM:40K OHM,0.1%,0.125W	75042	CEAT9-4002B
R1413	321-0924-07			RES.,FXD,FILM:40K OHM,0.1%,0.125W	75042	CEAT9-4002B
R1415	316-0823-00			RES.,FXD,CMPSN:82K OHM,10%,0.25W	01121	CB8231
R1416	316-0272-00			RES.,FXD,CMPSN:2.7K OHM,10%,0.25W	01121	CB2721
R1418	316-0472-00			RES.,FXD,CMPSN:4.7K OHM,10%,0.25W	01121	CB4721
R1420	315-0433-00			RES.,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
R1421	315-0753-00			RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
R1422	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R1424	316-0331-00			RES.,FXD,CMPSN:330 OHM,10%,0.25W	01121	CB3311
R1428	308-0702-00			RES.,FXD,WW:0.33 OHM,5%,2W	75042	BWH-R3300J
R1429	316-0471-00			RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
R1431	316-0683-00			RES.,FXD,CMPSN:68K OHM,10%,0.25W	01121	CB6831
R1432	316-0104-00			RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R1434	316-0334-00			RES.,FXD,CMPSN:330K OHM,10%,0.25W	01121	CB3341
R1436	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R1437	316-0274-00			RES.,FXD,CMPSN:270K OHM,10%,0.25W	01121	CB2741
R1440	321-0924-07			RES.,FXD,FILM:40K OHM,0.1%,0.125W	75042	CEAT9-4002B
R1441	321-1296-07			RES.,FXD,FILM:12K OHM,0.1%,0.125W	75042	CEAT9-1202B
R1443	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R1444	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R1446	316-0333-00			RES.,FXD,CMPSN:33K OHM,10%,0.25W	01121	CB3331
R1448	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R1449	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1451	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R1453	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R1456	316-0681-00			RES.,FXD,CMPSN:680 OHM,10%,0.25W	01121	CB6811
R1457	308-0701-00			RES.,FXD,WW:0.12 OHM,5%,2W	75042	BWH-R1200J
R1459	316-0151-00			RES.,FXD,CMPSN:150 OHM,10%,0.25W	01121	CB1511
R1461	316-0182-00			RES.,FXD,CMPSN:1.8K OHM,10%,0.25W	01121	CB1821
R1463	321-1296-07			RES.,FXD,FILM:12K OHM,0.1%,0.125W	75042	CEAT9-1202B
R1464	321-0332-07			RES.,FXD,FILM:28K OHM,0.1%,0.125W	75042	CEAT9-2802B
R1467	316-0184-00			RES.,FXD,CMPSN:180K OHM,10%,0.25W	01121	CB1841
R1480	316-0124-00			RES.,FXD,CMPSN:120K OHM,10%,0.25W	01121	CB1241
R1481	316-0471-00			RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
R1485	316-0272-00			RES.,FXD,CMPSN:2.7K OHM,10%,0.25W	01121	CB2721
R1487	316-0222-00			RES.,FXD,CMPSN:2.2K OHM,10%,0.25W	01121	CB2221
R1490	302-0822-00			RES.,FXD,CMPSN:8.2K OHM,10%,0.50W	01121	EB8221
R1492	316-0273-00			RES.,FXD,CMPSN:27K OHM,10%,0.25W	01121	CB2731
R1493	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R1495	316-0222-00			RES.,FXD,CMPSN:2.2K OHM,10%,0.25W	01121	CB2221
R1497	316-0681-00			RES.,FXD,CMPSN:680 OHM,10%,0.25W	01121	CB6811
R1498	308-0701-00			RES.,FXD,WW:0.12 OHM,5%,2W	75042	BWH-R1200J
R1499	316-0471-00			RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
R1502	316-0393-00			RES.,FXD,CMPSN:39K OHM,10%,0.25W	01121	CB3931
R1504	323-0264-00			RES.,FXD,FILM:5.49K OHM,1%,0.50W	75042	CECT0-5491F
R1506	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R1509	316-0224-00			RES.,FXD,CMPSN:220K OHM,10%,0.25W	01121	CB2241
R1512	321-0272-00			RES.,FXD,FILM:6.65K OHM,1%,0.125W	75042	CEAT0-6651F
R1513	311-1237-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	80294	3386H-T07-102
R1514	321-0338-00			RES.,FXD,FILM:32.4K OHM,1%,0.125W	75042	CEAT0-3242F
R1517	316-0125-00			RES.,FXD,CMPSN:1.2M OHM,10%,0.25W	01121	CB1251
R1518	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R1522	316-0472-00			RES.,FXD,CMPSN:4.7K OHM,10%,0.25W	01121	CB4721

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R1524	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R1528	316-0123-00			RES.,FXD,CMPSN:12K OHM,10%,0.25W	01121	CB1231
R1529	301-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.50W	01121	EB1235
R1531	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1533	316-0222-00			RES.,FXD,CMPSN:2.2K OHM,10%,0.25W	01121	CB2221
R1535	316-0331-00			RES.,FXD,CMPSN:330 OHM,10%,0.25W	01121	CB3311
R1537	308-0703-00			RES.,FXD,WW:1.8 OHM,5%,2W	75042	BWH1R80J
R1539	316-0471-00			RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
R1562	316-0274-00			RES.,FXD,CMPSN:270K OHM,10%,0.25W	01121	CB2741
R1564	321-0924-07			RES.,FXD,FILM:40K OHM,0.1%,0.125W	75042	CEAT9-4002B
R1565	321-0926-07			RES.,FXD,FILM:4K OHM,0.1%,0.125W	75042	CEAT9-4001B
R1566	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R1567	316-0273-00			RES.,FXD,CMPSN:27K OHM,10%,0.25W	01121	CB2731
R1568	316-0473-00			RES.,FXD,CMPSN:47K OHM,10%,0.25W	01121	CB4731
R1570	316-0334-00			RES.,FXD,CMPSN:330K OHM,10%,0.25W	01121	CB3341
R1571	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R1573	316-0471-00			RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
R1574	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R1577	316-0223-00			RES.,FXD,CMPSN:22K OHM,10%,0.25W	01121	CB2231
R1579	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R1580	315-0750-00			RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R1583	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R1586	316-0681-00			RES.,FXD,CMPSN:680 OHM,10%,0.25W	01121	CB6811
R1587	308-0701-00			RES.,FXD,WW:0.12 OHM,5%,2W	75042	BWH-R1200J
R1589	316-0470-00			RES.,FXD,CMPSN:47 OHM,10%,0.25W	01121	CB4701
R1591	316-0470-00			RES.,FXD,CMPSN:47 OHM,10%,0.25W	01121	CB4701
R1601	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R1602	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1604	321-0486-00			RES.,FXD,FILM:1.13M OHM,1%,0.125W	75042	CEAT0-1134F
R1606	321-0446-00			RES.,FXD,FILM:432K OHM,1%,0.125W	75042	CEAT0-4323F
R1609	311-1241-00			RES.,VAR,NONWIR:100K OHM,10%,0.5W	80294	3386H-M33-104
R1610	321-0486-00			RES.,FXD,FILM:1.13M OHM,1%,0.125W	75042	CEAT0-1134F
R1611	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R1613	315-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R1614	321-0448-00	XB010112		RES.,FXD,FILM:453K OHM,1%,0.125W	75042	CEAT0-4533F
R1615	307-0464-00	XB010112		RES.,FXD,FILM:59.6M OHM,1%,1W	03888	FL 1 59.6M 1%
R1615A, R1615B,C	307-0374-00	B010100	B010111X	RES.,FXD,FILM:HYBRID CKT	80009	307-0374-00
R1616	307-0463-00	XB010112		RES.,FXD,FILM:40.4M OHM,1%,1W	03888	FL 1 40.4M 1%
R1617	311-1241-00			RES.,VAR,NONWIR:100K OHM,10%,0.5W	80294	3386H-M33-104
R1620[1]	311-1569-00			RES.,VAR,NONWIR:250K OHM,20%,1W	01121	11M 616
R1621	307-0464-00	XB010112		RES.,FXD,FILM:59.6M OHM,1%,1W	03888	FL 1 59.6M 1%
R1622[2]	311-1256-00	XB010112	B180758	RES.,VAR,NONWIR:2.5M OHM,20%,0.50W	73138	72PM-78-0-255
R1622	311-1256-01	B180759		RES.,VAR,NONWIR:2.5M OHM,20%,0.50W	73138	72PM-78-0-255
R1623	307-0463-00	XB010112		RES.,FXD,FILM:40.4M OHM,1%,1W	03888	FL 1 40.4M 1%
R1624	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R1625	307-0416-00			RES.,FXD,FILM:1M OHM,10%,1W	03888	FL1-1004K
R1626	315-0226-00			RES.,FXD,CMPSN:22M OHM,5%,0.25W	01121	CB2265
R1628	301-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.50W	01121	EB2245
R1629	301-0514-00			RES.,FXD,CMPSN:510K OHM,5%,0.50W	01121	EB5145
R1631	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R1647	307-0417-00			RES.,FXD,FILM:43K OHM,10%,1W	03888	FL1-4302K
R1648	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R1650	306-0103-00			RES.,FXD,CMPSN:10K OHM,10%,2W	01121	HB1031

[1]Furnished as a unit with S256

[2]Replaceable under 119-0452-XX only.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R1654	311-1241-00			RES.,VAR,NONWIR:100K OHM,10%,0.5W	80294	3386H-M33-104
R1657	306-0103-00			RES.,FXD,CMPSN:10K OHM,10%,2W	01121	HB1031
R1660	315-0226-00			RES.,FXD,CMPSN:22M OHM,5%,0.25W	01121	CB2265
R1661	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R1663	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1664	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R1671	321-0066-00			RES.,FXD,FILM:47.5 OHM,1%,0.125W	75042	CEAT0-47R50F
R1672	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1673	321-0316-00			RES.,FXD,FILM:19.1K OHM,1%,0.125W	75042	CEAT0-1912F
R1674	321-0066-00			RES.,FXD,FILM:47.5 OHM,1%,0.125W	75042	CEAT0-47R50F
R1675	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1677	323-0163-00	B010100	B010111	RES.,FXD,FILM:487 OHM,1%,0.50W	75042	CECT0-4870F
R1677	323-0181-00	B010112		RES.,FXD,FILM:750 OHM,1%,0.50W	75042	CECT0-7500F
R1678	315-0110-00			RES.,FXD,CMPSN:11 OHM,5%,0.25W	01121	CB1105
R1680	321-0139-00			RES.,FXD,FILM:274 OHM,1%,0.125W	75042	CEAT0-2740F
R1682	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R1683	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R1685	321-0243-00			RES.,FXD,FILM:3.32K OHM,1%,0.125W	75042	CEAT0-3321F
R1686	321-0264-00			RES.,FXD,FILM:5.49K OHM,1%,0.125W	75042	CEAT0-5491F
R1688	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R1690	315-0160-00	B010100	B130456	RES.,FXD,CMPSN:16 OHM,5%,0.25W	01121	CB1605
R1690	315-0100-00	B130457	B139999	RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1690	315-0100-00	B140000		RES.,FXD,CMPSN:10 OHM,(NOM VALUE),SEL	01121	CB1005
R1692	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R1693	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1696	321-0357-00			RES.,FXD,FILM:51.1K OHM,1%,0.125W	75042	CEAT0-5112F
R1697	321-0324-00			RES.,FXD,FILM:23.2K OHM,1%,0.125W	75042	CEAT0-2322F
R1699	315-0205-00			RES.,FXD,CMPSN:2M OHM,5%,0.25W	01121	CB2055
R1701	311-1239-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	73138	72Y-26-0-252K
R1703	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R1704	321-0329-00	B010100	B010111	RES.,FXD,FILM:26.1K OHM,1%,0.125W	75042	CEAT0-2612F
R1704	321-0334-00	B010112		RES.,FXD,FILM:29.4K OHM,1%,0.125W	75042	CEAT0-2942F
R1705	321-0450-00			RES.,FXD,FILM:475K OHM,1%,0.125W	75042	CEAT0-4753F
R1707	323-0305-00			RES.,FXD,FILM:14.7K OHM,1%,0.50W	75042	CECT0-1472F
R1711	315-0121-00			RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
R1713	321-0164-00			RES.,FXD,FILM:499 OHM,1%,0.125W	75042	CEAT0-4990F
R1715	321-0392-00			RES.,FXD,FILM:118K OHM,1%,0.125W	75042	CEAT0-1183F
R1716	321-0313-00			RES.,FXD,FILM:17.8K OHM,1%,0.125W	75042	CEAT0-1782F
R1719	322-0643-00			RES.,FXD,FILM:600K OHM,1%,0.25W	75042	CEBT0-6003F
R1720	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R1721	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R1722	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R1723	315-0240-00			RES.,FXD,CMPSN:24 OHM,5%,0.25W	01121	CB2405
R1725	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1726	301-0166-00			RES.,FXD,CMPSN:16M OHM,5%,0.50W	01121	EB1665
R1727	315-0106-00			RES.,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
R1729	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R1731	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R1734	321-0261-00			RES.,FXD,FILM:5.11K OHM,1%,0.125W	75042	CEAT0-5111F
R1735	321-0261-00			RES.,FXD,FILM:5.11K OHM,1%,0.125W	75042	CEAT0-5111F
R1737	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R1738	306-0103-00	XB020000		RES.,FXD,CMPSN:10K OHM,10%,2W	01121	HB1031
R1739	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815

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R1740	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R1741	321-0303-00			RES.,FXD,FILM:14K OHM,1%,0.125W	75042	CEAT0-1402F
R1742	315-0102-00	XB020000		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1743	315-0473-00	B010100	B019999	RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R1743	315-0472-00	B020000		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1744	321-0418-00	B010100	B010169	RES.,FXD,FILM:221K OHM,1%,0.125W	75042	CEAT0-2213F
R1744	321-0398-00	B010170		RES.,FXD,FILM:137K OHM,1%,0.125W	75042	CEAT0-1373F
R1745	321-0377-00	B010100	B010169	RES.,FXD,FILM:82.5K OHM,1%,0.125W	75042	CEAT0-8252F
R1745	321-0388-00	B010170		RES.,FXD,FILM:107K OHM,1%,0.125W	75042	CEAT0-1073F
R1746	321-0325-00			RES.,FXD,FILM:23.7K OHM,1%,0.125W	75042	CEAT0-2372F
R1747	321-0399-00			RES.,FXD,FILM:140K OHM,1%,0.125W	75042	CEAT0-1403F
R1748	321-0295-00			RES.,FXD,FILM:11.5K OHM,1%,0.125W	75042	CEAT0-1152F
R1749	321-0285-00			RES.,FXD,FILM:9.09K OHM,1%,0.125W	75042	CEAT0-9091F
R1750	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	75042	CEAT0-1003F
R1751	321-0265-00			RES.,FXD,FILM:5.62K OHM,1%,0.125W	75042	CEAT0-5621F
R1752	311-1245-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	72X-28-0-103K
R1753	321-0234-00			RES.,FXD,FILM:2.67K OHM,1%,0.125W	75042	CEAT0-2671F
R1755	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R1757	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R1758	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1760	315-0475-00			RES.,FXD,CMPSN:4.7M OHM,5%,0.25W	01121	CB4755
R1761	316-0225-00			RES.,FXD,CMPSN:2.2M OHM,10%,0.25W	01121	CB2251
R1762	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R1764	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1765	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R1767	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1769	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1770	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1771	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1772	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R1773	315-0163-00			RES.,FXD,CMPSN:16K OHM,5%,0.25W	01121	CB1635
R1775	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1776	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1777	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R1778	315-0163-00			RES.,FXD,CMPSN:16K OHM,5%,0.25W	01121	CB1635
R1780	311-1241-00			RES.,VAR,NONWIR:100K OHM,10%,0.5W	80294	3386H-M33-104
R1781	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	75042	CEAT0-1003F
R1782	311-1243-00			RES.,VAR,NONWIR:500K OHM,10%,0.50W	73138	72X-34-0-504K
R1783	321-0402-00			RES.,FXD,FILM:150K OHM,1%,0.125W	75042	CEAT0-1503F
R1784	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1785	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1786	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1787	315-0240-00			RES.,FXD,CMPSN:24 OHM,5%,0.25W	01121	CB2405
R1788	301-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.50W	01121	EB1545
R1789	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R1790	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R1791	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1793	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1794	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R1795	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1797	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1798	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1799	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005

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R1801	315-0202-00	B010100	B010111X	RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R1802	315-0102-00	B010100	B010111X	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1805	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R1806	315-0754-00			RES.,FXD,CMPSN:750K OHM,5%,0.25W	01121	CB7545
R1807	315-0155-00			RES.,FXD,CMPSN:1.5M OHM,5%,0.25W	01121	CB1555
R1809	311-1228-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	80294	3386F-T04-103
R1811	321-0272-07			RES.,FXD,FILM:6.65K OHM,0.1%,0.125W	75042	CEAT9-6651B
R1813	323-0315-00			RES.,FXD,FILM:18.7K OHM,1%,0.50W	75042	CECT0-1872F
R1814	315-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R1815	321-0216-00			RES.,FXD,FILM:1.74K OHM,1%,0.125W	75042	CEAT0-1741F
R1817	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R1818	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R1819	303-0823-00			RES.,FXD,CMPSN:82K OHM,5%,1W	01121	GB8235
R1823	308-0623-00			RES.,FXD,WW:167 OHM,1%,3W	91637	RS2B-B167R0F
R1825	321-0298-09			RES.,FXD,FILM:12.4K OHM,1%,0.125W	91637	MFF1816C12401F
R1827	311-1235-00			RES.,VAR,NONWIR:100K OHM;20%,0.50W	80294	3386F-T04-104
R1829	321-0452-09			RES.,FXD,FILM:499K OHM,1%,0.125W	91637	MFF1816C49902F
R1830	321-0298-09			RES.,FXD,FILM:12.4K OHM,1%,0.125W	91637	MFF1816C12401F
R1832	315-0226-00			RES.,FXD,CMPSN:22M OHM,5%,0.25W	01121	CB2265
R1833	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1835	315-0304-00	B010100	B010111X	RES.,FXD,CMPSN:300K OHM,5%,0.25W	01121	CB3045
R1836	305-0563-00			RES.,FXD,CMPSN:56K OHM,5%,2W	01121	HB5635
R1837	323-0452-09			RES.,FXD,FILM:499K OHM,1%,0.50W	91637	MFF1816C49902F
R1839	303-0333-00			RES.,FXD,CMPSN:33K OHM,5%,1W	01121	GB3335
R1840	303-0333-00			RES.,FXD,CMPSN:33K OHM,5%,1W	01121	GB3335
R1842	315-0103-00	B010100	B010111X	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1843	315-0824-00	B010100	B010111X	RES.,FXD,CMPSN:820K OHM,5%,0.25W	01121	CB8245
R1844	315-0103-00	B010100	B010111X	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1846	315-0102-00	B010100	B010111X	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1850	317-0561-00	B010100	B069999	RES.,FXD,CMPSN:560 OHM,5%,0.125W	01121	BB5615
R1850	317-0621-00	B070000		RES.,FXD,CMPSN:620 OHM,5%,0.125W	01121	BB6215
R1851	315-0111-00	B010100	B069999	RES.,FXD,CMPSN:110 OHM,5%,0.25W	01121	CB1115
R1851	315-0680-00	B070000		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
R1853	305-0750-00	B010100	B069999	RES.,FXD,CMPSN:75 OHM,5%,2W	01121	HB7505
R1853	305-0680-00	B070000		RES.,FXD,CMPSN:68 OHM,5%,2W	01121	HB6805
R1860	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1861	315-0750-00			RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R1863	307-0106-00			RES.,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB47G5
R1865	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R1867	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R1868	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R1873	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1874	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R1875	315-0393-00			RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R1876	321-0444-00			RES.,FXD,FILM:412K OHM,1%,0.125W	75042	CEAT0-4123F
R1877	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1878	315-0912-00			RES.,FXD,CMPSN:9.1K OHM,5%,0.25W	01121	CB9125
R1879	315-0433-00			RES.,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
R1880	315-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R1882	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1883	315-0104-00	B010100	B010111	RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R1883	315-0433-00	B010112		RES.,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
R1885	321-0356-00			RES.,FXD,FILM:49.9K OHM,1%,0.125W	75042	CEAT0-4992F

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R1886	321-0134-00	B010100	B010111	RES.,FXD,FILM:243 OHM,1%,0.125W	75042	CEAT0-2430F
R1886	321-0260-00	B010112		RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R1887	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	75042	CEAT0-1004F
R1888	321-0410-00	B010100	B010111	RES.,FXD,FILM:182K OHM,1%,0.125W	75042	CEAT0-1823F
R1888	321-0414-00	B010112		RES.,FXD,FILM:200K OHM,1%,0.125W	75042	CEAT0-2003F
R1890	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	75042	CEAT0-1004F
R1891	321-0410-00	B010100	B010111	RES.,FXD,FILM:182K OHM,1%,0.125W	75042	CEAT0-1823F
R1891	321-0414-00	B010112		RES.,FXD,FILM:200K OHM,1%,0.125W	75042	CEAT0-2003F
R1893	315-0106-00	B010100	B010111	RES.,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
R1893	322-0519-01	B010112		RES.,FXD,FILM:2.49M OHM,0.5%,0.25W	91637	HMF143G24903D
R1894	311-0613-00			RES.,VAR,NONWIR:100K OHM,10%,0.50W	80740	62-63-3
R1895	315-0472-00	B010100	B010111	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1895	321-0354-00	B010112		RES.,FXD,FILM:47.5K OHM,1%,0.125W	75042	CEAT0-4752F
R1897	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1899	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R1900	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R1903	315-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R1905	323-0126-00			RES.,FXD,FILM:200 OHM,1%,0.50W	75042	CECT0-2000F
R1907	323-0350-00			RES.,FXD,FILM:43.2K OHM,1%,0.50W	75042	CECT0-4322F
R1908	321-0263-00			RES.,FXD,FILM:5.36K OHM,1%,0.125W	75042	CEAT0-5361F
R1909	321-0312-00			RES.,FXD,FILM:17.4K OHM,1%,0125W	75042	CEAT0-1742F
R1910	311-1234-00			RES.,VAR,NONWIR:50K OHM,20%,0.50W	80294	3386F-T06-503
R1911	321-0263-00			RES.,FXD,FILM:5.36K OHM,1%,0.125W	75042	CEAT0-5361F
R1913	323-0350-00			RES.,FXD,FILM:43.2K OHM,1%,0.50W	75042	CECT0-4322F
R1915	323-0126-00			RES.,FXD,FILM:200 OHM,1%,0.50W	75042	CECT0-2000F
R1923	315-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R1925	323-0126-00			RES.,FXD,FILM:200 OHM,1%,0.50W	75042	CECT0-2000F
R1927	323-0350-00			RES.,FXD,FILM:43.2K OHM,1%,0.50W	75042	CECT0-4322F
R1928	321-0263-00			RES.,FXD,FILM:5.36K OHM,1%,0.125W	75042	CEAT0-5361F
R1929	321-0312-00			RES.,FXD,FILM:17.4K OHM,1%,0125W	75042	CEAT0-1742F
R1930	311-1234-00			RES.,VAR,NONWIR:50K OHM,20%,0.50W	80294	3386F-T06-503
R1931	321-0263-00			RES.,FXD,FILM:5.36K OHM,1%,0.125W	75042	CEAT0-5361F
R1933	323-0350-00			RES.,FXD,FILM:43.2K OHM,1%,0.50W	75042	CECT0-4322F
R1935	323-0126-00			RES.,FXD,FILM:200 OHM,1%,0.50W	75042	CECT0-2000F
R1937	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1938	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1940	307-0106-00			RES.,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB47G5
R1941	307-0106-00			RES.,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB47G5
R1943	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1944	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1946	301-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.50W	01121	EB1035
R1947	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R1948	321-0376-00			RES.,FXD,FILM:80.6K OHM,1%,0.125W	75042	CEAT0-8062F
R1949	321-0317-00			RES.,FXD,FILM:19.6K OHM,1%,0.125W	75042	CEAT0-1962F
R1951	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R1952	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	62PT-351-0
R1953	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R1955	316-0565-00			RES.,FXD,CMPSN:5.6M OHM,10%,0.25W	01121	CB5651
R1956	315-0475-00			RES.,FXD,CMPSN:4.7M OHM,5%,0.25W	01121	CB4755
R1957	319-0031-00			RES.,FXD,FILM:1M OHM,1%,0.25W	91637	DC1423-10003F
R1958	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R1959	308-0291-00			RES.,FXD,WW:2K OHM,5%,3W	91637	RS2B-B2000J
R1961	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035

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R1963	315-0204-00			RES.,FXD,CMPSN:200K OHM,5%,0.25W	01121	CB2045
R1966	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R1968	315-0163-00			RES.,FXD,CMPSN:16K OHM,5%,0.25W	01121	CB1635
R1971	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1972	311-1259-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	80294	3329P-L58-101
R1973	315-0270-00	B010100	B010141	RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R1973	315-0101-00	B010142		RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1975	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R1976	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R1977	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R1979	311-1228-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	80294	3386F-T04-103
R1980	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R1981	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R1983	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R1985	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R1986	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R1987	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1989	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1992	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R1993	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1994	321-0125-00			RES.,FXD,FILM:196 OHM,1%,0.125W	75042	CEAT0-1960F
R1996	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R1997	315-0330-00			RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
R1998	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2120	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R2121	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R2123	321-0233-00			RES.,FXD,FILM:2.61K OHM,1%,0.125W	75042	CEAT0-2611F
R2125	321-0356-00			RES.,FXD,FILM:49.9K OHM,1%,0.125W	75042	CEAT0-4992F
R2127	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	62PT-351-0
R2130	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R2131	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R2133	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R2135	321-0241-00			RES.,FXD,FILM:3.16K OHM,1%,0.125W	75042	CEAT0-3161F
R2139	321-0256-00			RES.,FXD,FILM:4.53K OHM,1%,0.125W	75042	CEAT0-4531F
R2141	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R2144	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R2145	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R2147	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	62PT-351-0
R2149	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2152	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F
R2153	321-0298-00			RES.,FXD,FILM:12.4K OHM,1%,0.125W	75042	CEAT0-1242F
R2154	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F
R2156	321-0298-00			RES.,FXD,FILM:12.4K OHM,1%,0.125W	75042	CEAT0-1242F
R2158	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R2160	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R2161	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R2163	321-0233-00			RES.,FXD,FILM:2.61K OHM,1%,0.125W	75042	CEAT0-2611F
R2165	321-0356-00			RES.,FXD,FILM:49.9K OHM,1%,0.125W	75042	CEAT0-4992F
R2167	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	62PT-351-0
R2170	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R2171	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R2173	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R2175	321-0241-00			RES.,FXD,FILM:3.16K OHM,1%,0.125W	75042	CEAT0-3161F

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R2179	321-0256-00			RES.,FXD,FILM:4.53K OHM,1%,0.125W	75042	CEAT0-4531F
R2181	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R2184	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R2185	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R2187	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	62PT-351-0
R2189	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2192	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F
R2193	321-0298-00			RES.,FXD,FILM:12.4K OHM,1%,0.125W	75042	CEAT0-1242F
R2194	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F
R2196	321-0298-00			RES.,FXD,FILM:12.4K OHM,1%,0.125W	75042	CEAT0-1242F
R2198	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R2201	311-1225-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	80294	3386F-T04-102
R2203	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R2204	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R2207	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R2210	321-0231-00			RES.,FXD,FILM:2.49K OHM,1%,0.125W	75042	CEAT0-2491F
R2212	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2213	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2214	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R2217	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R2220	321-0135-00			RES.,FXD,FILM:249 OHM,1%,0.125W	75042	CEAT0-2490F
R2222	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2223	315-0621-00			RES.,FXD,CMPSN:620 OHM,5%,0.25W	01121	CB6215
R2225	321-0231-00			RES.,FXD,FILM:2.49K OHM,1%,0.125W	75042	CEAT0-2491F
R2226	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R2228	321-0304-00			RES.,FXD,FILM:14.3K OHM,1%,0.125W	75042	CEAT0-1432F
R2229	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2230	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R2231	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2232	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R2234	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2235	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R2240	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R2241	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2243	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2245	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2247	315-0163-00			RES.,FXD,CMPSN:16K OHM,5%,0.25W	01121	CB1635
R2248	315-0683-00			RES.,FXD,CMPSN:68K OHM,5%,0.25W	01121	CB6835
R2249	315-0133-00			RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
R2251	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2253	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R2255	315-0820-00			RES.,FXD,CMPSN:82 OHM,5%,0.25W	01121	CB8205
R2256	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2257	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R2259	315-0680-00			RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
R2261	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2262	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2265	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R2266	311-1228-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	80294	3386F-T04-103
R2268	321-0327-00			RES.,FXD,FILM:24.9K OHM,1%,0.125W	75042	CEAT0-2492F
R2269	321-0327-00			RES.,FXD,FILM:24.9K OHM,1%,0.125W	75042	CEAT0-2492F
R2270	321-0195-00			RES.,FXD,FILM:1.05K OHM,1%,0.125W	75042	CEAT0-1051F
R2272	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F

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R2274	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R2275	323-0318-00			RES.,FXD,FILM:20K OHM,1%,0.50W	75042	CECT0-2002F
R2277	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R2279	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2281	321-0220-00			RES.,FXD,FILM:1.91K OHM,1%,0.125W	75042	CEAT0-1911F
R2283	315-0360-00			RES.,FXD,CMPSN:36 OHM,5%,0.25W	01121	CB3605
R2284	321-0220-00			RES.,FXD,FILM:1.91K OHM,1%,0.125W	75042	CEAT0-1911F
R2286	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R2287	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R2289	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2291	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2294	315-0332-00	XB010112		RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R2295	315-0102-00	B010100	B010111	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2295	315-0472-00	B010112		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2296	315-0102-00	B010100	B010111X	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2298	315-0102-00	B010100	B010111	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2298	315-0472-00	B010112		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2300	315-0202-00	B010100	B010111X	RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2302	315-0102-00	B010100	B010111X	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2304	315-0103-00	B010100	B010111	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2304	315-0472-00	B010112		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2306	315-0512-00	B010100	B010111	RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R2306	315-0472-00	B010112		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2307	315-0514-00	B010100	B010111X	RES.,FXD,CMPSN:510K OHM,5%,0.25W	01121	CB5145
R2308	311-1233-00	B010100	B010111	RES.,VAR,NONWIR:50K OHM,10%,0.50W	80294	3386F-T05-503
R2308	315-0393-00	B010112		RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R2310	315-0102-00	B010100	B010111	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2310	315-0221-00	B010112		RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R2311	321-0289-00	XB010112		RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R2312	315-0393-00	B010100	B010111	RES.,FXD,CMPSN:39K OHM,5%,0.25W	80294	3386F-T05-503
R2312	311-1233-00	B010112		RES.,VAR,NONWIR:50K OHM,10%,0.50W	80294	3386F-T05-503
R2314	315-0102-00	B010100	B010111	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2314	315-0101-00	B010112		RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R2315	315-0102-00	B010100	B010111X	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2317	315-0103-00	B010100	B010111	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2317	315-0222-00	B010112		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2320	321-0123-00			RES.,FXD,FILM:187 OHM,1%,0.125W	75042	CEAT0-1870F
R2321	321-0106-00			RES.,FXD,FILM:124 OHM,1%,0.125W	75042	CEAT0-1240F
R2323	315-0911-00	B010100	B119999	RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R2323	315-0122-00	B120000		RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R2324	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2326	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R2327	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2341	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R2343	315-0242-00	B010100	B119999	RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R2343	315-0362-00	B120000		RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R2344	315-0272-00	B010100	B119999	RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2344	315-0392-00	B120000		RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R2347	315-0222-00	B010100	B090341	RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2347	315-0122-00	B090342		RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R2348	315-0303-00	B010100	B090341	RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R2348	315-0622-00	B090342		RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R2352	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025

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R2354	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R2356	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2357	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2358	315-0750-00			RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R2361	315-0820-00			RES.,FXD,CMPSN:82 OHM,5%,0.25W	01121	CB8205
R2362	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2381	307-0106-00			RES.,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB47G5
R2382	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2383	307-0106-00			RES.,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB47G5
R2384	307-0106-00			RES.,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB47G5
R2390	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R2400	315-0470-00	XB010142		RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R2401	315-0133-00	XB010142		RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
R2402	315-0362-00	XB010142		RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R2403	315-0182-00	B010100	B010141X	RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2404	315-0362-00	XB010142		RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R2405	315-0100-00	XB010142		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2406	315-0473-00	B010100	B010141X	RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R2407	315-0472-00	B010100	B010141X	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2408	315-0162-00	XB010142		RES.,FXD,CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
R2409	315-0103-00	B010100	B010141	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2409	315-0820-00	B010142		RES.,FXD,CMPSN:82 OHM,5%,0.25W	01121	CB8205
R2411	315-0472-00	B010100	B010141	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2411	315-0182-00	B010142		RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2413	315-0472-00	B010100	B010141	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2413	315-0473-00	B010142		RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R2414	315-0472-00	XB010142		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2415	315-0103-00	XB010142		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2416	315-0472-00	XB010142		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2417	321-0280-00	B010100	B010141	RES.,FXD,FILM:8.06K OHM,1%,0.125W	75042	CEAT0-8061F
R2417	315-0472-00	B010142		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2419	315-0182-00	B010100	B010141	RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2419	321-0280-00	B010142		RES.,FXD,FILM:8.06K OHM,1%,0.125W	75042	CEAT0-8061F
R2421	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2423	315-0182-00	XB010142		RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2424	311-1198-00	B010100	B010141X	RES.,VAR,NONWIR:20K OHM,20%,0.5W	80294	3389H
R2425	311-1198-00	XB010142		RES.,VAR,NONWIR:20K OHM,20%,0.5W	80294	3389H
R2427	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R2429	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2432	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R2436	315-0512-00	XB010142		RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R2438	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2440	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R2441	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R2442	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R2445	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R2446	315-0132-00			RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325
R2448	315-0104-00	B010100	B130456	RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R2448	315-0823-00	B130457		RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R2450[1]	311-1578-00			RES.,VAR,NONWIR:25 X 25K OHM,2%,0.5W	01121	11M706
R2452	315-0184-00			RES.,FXD,CMPSN:180K OHM,5%,0.25W	01121	CB1845
R2455	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R2459	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015

[1]Furnished as a unit with R259 and S259

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R2468	315-0112-00			RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	01121	CB1125
R2470	315-0103-00	B010100	B139999	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2470	315-0752-00	B140000		RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R2472	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R2473	315-0132-00			RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325
R2474	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R2475	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R2478	315-0112-00			RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	01121	CB1125
R2479	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2481	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2483	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R2485	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R2486	315-0132-00			RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325
R2488	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R2489	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R2491	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R2494	321-0425-00			RES.,FXD,FILM:261K OHM,1%,0.125W	75042	CEAT0-2613F
R2498	321-0422-00			RES.,FXD,FILM:243K OHM,1%,0.125W	75042	CEAT0-2433F
R2500	321-0244-00			RES.,FXD,FILM:3.4K OHM,1%,0.125W	75042	CEAT0-3401F
R2501	321-0212-00			RES.,FXD,FILM:1.58K OHM,1%,0.125W	75042	CEAT0-1581F
R2503	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R2505	321-0311-00			RES.,FXD,FILM:16.9K OHM,1%,0.125W	75042	CEAT0-1692F
R2506	321-0250-00			RES.,FXD,FILM:3.92K OHM,1%,0.125W	75042	CEAT0-3921F
R2507	321-0270-00			RES.,FXD,FILM:6.34K OHM,1%,0.125W	75042	CEAT0-6341F
R2508	321-0328-00			RES.,FXD,FILM:25.5K OHM,1%,0.125W	75042	CEAT0-2552F
R2510	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R2512	323-0269-09			RES.,FXD,FILM:6.19K OHM,1%,0.50W	91637	MFF1816C61900F
R2513	311-1239-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	73138	72Y-26-0-252K
R2515	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R2516	315-0132-00			RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325
R2518	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R2520	321-0267-00			RES.,FXD,FILM:5.9K OHM,1%,0.125W	75042	CEAT0-5901F
R2522	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R2523	315-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	01121	CB8225
R2525	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2527	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	75042	CEAT0-4751F
R2528	321-0264-08			RES.,FXD,FILM:5.49K OHM,1%,0.125W	91637	MFF1816D54900F
R2529	321-0176-00			RES.,FXD,FILM:665 OHM,1%,0.125W	75042	CEAT0-6650F
R2531	321-0164-08			RES.,FXD,FILM:499 OHM,1%,0.125W	91637	MFF1816D499R0F
R2533	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R2534	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R2536	321-0129-00			RES.,FXD,FILM:215 OHM,1%,0.125W	75042	CEAT0-2150F
R2538	321-0164-08			RES.,FXD,FILM:499 OHM,1%,0.125W	91637	MFF1816D499R0F
R2539	321-0197-08			RES.,FXD,FILM:1.1K OHM,1%,0.125W	91637	MFF1816D11000F
R2540	311-1237-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	80294	3386H-T07-102
R2542	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	75042	CEAT0-3651F
R2543	311-1236-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	73138	72X-22-0-251K
R2544	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	75042	CEAT0-3651F
R2546	321-0176-00			RES.,FXD,FILM:665 OHM,1%,0.125W	75042	CEAT0-6650F
R2549	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F
R2551	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R2553	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R2555	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F

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R2560	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2562	321-0253-08			RES.,FXD,FILM:4.22K OHM,1%,0.125W	91637	MFF1816D42200F
R2563	321-1607-08			RES.,FXD,FILM:1.86K OHM,1%,0.125W	91637	MFF1816D18600F
R2564	321-0283-08			RES.,FXD,FILM:8.66K OHM,1%,0.125W	91637	MFF1816D86600F
R2565	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2567	321-0355-08			RES.,FXD,FILM:48.7K OHM,1%,0.125W	91637	MFF1816D48701F
R2569	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R2570	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R2571	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R2572	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2575	321-0202-00			RES.,FXD,FILM:1.24K OHM,1%,0.125W	75042	CEAT0-1241F
R2576	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2578	321-0242-08			RES.,FXD,FILM:3.24K OHM,1%,0.125W	91637	MFF1816D32400F
R2579	321-0255-08			RES.,FXD,FILM:4.42K OHM,1%,0.125W	91637	MFF1816D44200F
R2580	321-0277-08			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816D75000F
R2581	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2583	321-0338-08			RES.,FXD,FILM:32.4K OHM,1%,0.125W	91637	MFF1816D32401F
R2585	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R2587	315-0912-00			RES.,FXD,CMPSN:9.1K OHM,5%,0.25W	01121	CB9125
R2590	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R2592	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2593	315-0133-00			RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
R2595	321-0414-09			RES.,FXD,FILM:200K OHM,1%,0.125W	91637	MFF1816C20002F
R2597	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R2598	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R2599	315-0273-00			RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
R2603	321-0327-00			RES.,FXD,FILM:24.9K OHM,1%,0.125W	75042	CEAT0-2492F
R2605	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R2608	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2610	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2612	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R2613	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R2616	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R2617	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2619	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2620	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R2621	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2623	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R2626	321-0248-08			RES.,FXD,FILM:3.74K OHM,1%,0.125W	91637	MFF1816D37400F
R2627	321-0283-08			RES.,FXD,FILM:8.66K OHM,1%,0.125W	91637	MFF1816D86600F
R2628	321-0323-08			RES.,FXD,FILM:22.6K OHM,1%,0.125W	91637	MFF1816D22601F
R2629	321-0176-00			RES.,FXD,FILM:665 OHM,1%,0.125W	75042	CEAT0-6650F
R2631	321-0164-08			RES.,FXD,FILM:499 OHM,1%,0.125W	91637	MFF1816D499R0F
R2633	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R2634	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R2636	321-0129-00			RES.,FXD,FILM:215 OHM,1%,0.125W	75042	CEAT0-2150F
R2638	321-0164-08			RES.,FXD,FILM:499 OHM,1%,0.125W	91637	MFF1816D499R0F
R2639	321-0197-08			RES.,FXD,FILM:1.1K OHM,1%,0.125W	91637	MFF1816D11000F
R2640	311-1237-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	80294	3386H-T07-102
R2642	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	75042	CEAT0-3651F
R2643	311-1236-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	73138	72X-22-0-251K
R2644	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	75042	CEAT0-3651F
R2646	321-0176-00			RES.,FXD,FILM:665 OHM,1%,0.125W	75042	CEAT0-6650F

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R2649	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F
R2651	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R2653	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R2655	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F
R2660	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R2681	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2684	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2698	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2702	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R2703	315-0183-00	B010100	B090341	RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R2703	315-0393-00	B090342		RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R2704	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R2708	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	75042	CEAT0-2002F
R2710	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	75042	CEAT0-7501F
R2714	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	75042	CEAT0-2002F
R2716	307-0104-00			RES.,FXD,CMPSN:3.3 OHM,5%,0.25W	01121	CB33G5
R2718	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2719	321-0356-00			RES.,FXD,FILM:49.9K OHM,1%,0.125W	75042	CEAT0-4992F
R2720	321-0345-00	B010100	B090341	RES.,FXD,FILM:38.3K OHM,1%,0.125W	75042	CEAT0-3832F
R2720	321-0348-00	B090342		RES.,FXD,FILM:41.2K OHM,1%,0.125W	75042	CEAT0-4122F
R2723	321-0238-00			RES.,FXD,FILM:2.94K OHM,1%,0.125W	75042	CEAT0-2941F
R2724	321-0224-00	B010100	B090341	RES.,FXD,FILM:2.1K OHM,1%,0.125W	75042	CEAT0-2101F
R2724	321-0201-00	B090342		RES.,FXD,FILM:1.21K OHM,1%,0.125W	75042	CEAT0-1211F
R2726	315-0132-00			RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325
R2727	315-0103-00	XB090342		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2728	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2729	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2733	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2735	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2738	315-0100-00	B010100	B010141	RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2738	315-0472-00	B010142		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2739	315-0302-00	B010100	B010111	RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R2739	315-0222-00	B010112		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2749	321-0265-00			RES.,FXD,FILM:5.62K OHM,1%,0.125W	75042	CEAT0-5621F
R2762	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R2771	321-0281-00			RES.,FXD,FILM:8.25K OHM,1%,0.125W	75042	CEAT0-8251F
R2773	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2774	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2776	321-0253-00			RES.,FXD,FILM:4.22K OHM,1%,0.125W	75042	CEAT0-4221F
R2778	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2779	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2781	321-0287-00			RES.,FXD,FILM:9.53K OHM,1%,0.125W	75042	CEAT0-9531F
R2783	321-0347-00			RES.,FXD,FILM:40.2K OHM,1%,0.125W	75042	CEAT0-4022F
R2786	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	75042	CEAT0-2002F
R2791	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2794	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2796	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2798	307-0115-00			RES.,FXD,CMPSN:7.5 OHM,5%,0.25W	01121	CB75G5
R2803	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2807	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2810	311-1228-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	80294	3386F-T04-103
R2811	315-0202-00	B010100	B010141	RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2811	315-0512-00	B010142		RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125

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R2816	315-0472-00	XB010142		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2820	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2825	315-0752-00	B010100	B019999	RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R2825	315-0222-00	B020000		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2828	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2860	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2865	315-0752-00	B010100	B019999	RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R2865	315-0222-00	B020000		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2877	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2886	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2902	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R2903	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R2904	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R2905	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2912	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R2916	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2920	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R2923	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R2928	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2929	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2931	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R2935	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R2937	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R2939	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R2941	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R2942	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R2957	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R2960	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R2962	315-0302-00	XB010112		RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R2996	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3001	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R3003	315-0821-00	XB010142		RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
R3006	315-0821-00	XB010142		RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
R3080	317-0221-00	XB010142	B019999	RES.,FXD,CMPSN:220 OHM,5%,0.125W	01121	BB2215
R3080	317-0121-00	B020000	B129999X	RES.,FXD,CMPSN:120 OHM,5%,0.125W	01121	BB1215
R3082	317-0221-00	XB010142	B019999	RES.,FXD,CMPSN:220 OHM,5%,0.125W	01121	BB2215
R3082	317-0121-00	B020000	B129999X	RES.,FXD,CMPSN:120 OHM,5%,0.125W	01121	BB1215
R3084	317-0221-00	XB010142	B019999	RES.,FXD,CMPSN:220 OHM,5%,0.125W	01121	BB2215
R3084	317-0121-00	B020000	B129999X	RES.,FXD,CMPSN:120 OHM,5%,0.125W	01121	BB1215
R3086	317-0221-00	XB010142	B019999	RES.,FXD,CMPSN:220 OHM,5%,0.125W	01121	BB2215
R3086	317-0121-00	B020000	B129999X	RES.,FXD,CMPSN:120 OHM,5%,0.125W	01121	BB1215
R3088	317-0221-00	XB010142	B019999	RES.,FXD,CMPSN:220 OHM,5%,0.125W	01121	BB2215
R3088	317-0121-00	B020000	B129999X	RES.,FXD,CMPSN:120 OHM,5%,0.125W	01121	BB1215
R3090	317-0221-00	XB010142	B019999	RES.,FXD,CMPSN:220 OHM,5%,0.125W	01121	BB2215
R3090	317-0121-00	B020000	B129999X	RES.,FXD,CMPSN:120 OHM,5%,0.125W	01121	BB1215
R3091	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R3092	317-0221-00	XB010142	B019999	RES.,FXD,CMPSN:220 OHM,5%,0.125W	01121	BB2215
R3092	317-0121-00	B020000	B129999X	RES.,FXD,CMPSN:120 OHM,5%,0.125W	01121	BB1215
R3094	317-0221-00	XB010142	B019999	RES.,FXD,CMPSN:220 OHM,5%,0.125W	01121	BB2215
R3094	317-0121-00	B020000	B129999X	RES.,FXD,CMPSN:120 OHM,5%,0.125W	01121	BB1215
R3096	317-0221-00	XB010142	B019999	RES.,FXD,CMPSN:220 OHM,5%,0.125W	01121	BB2215
R3096	317-0121-00	B020000	B129999X	RES.,FXD,CMPSN:120 OHM,5%,0.125W	01121	BB1215
R3098	317-0221-00	XB010142	B019999	RES.,FXD,CMPSN:220 OHM,5%,0.125W	01121	BB2215

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R3098	317-0121-00	B020000	B129999X	RES.,FXD,CMPSN:120 OHM,5%,0.125W	01121	BB1215
R3201	316-0273-00			RES.,FXD,CMPSN:27K OHM,10%,0.25W	01121	CB2731
R3202	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R3204	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R3205	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R3208	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R3210	316-0473-00			RES.,FXD,CMPSN:47K OHM,10%,0.25W	01121	CB4731
R3211	316-0152-00			RES.,FXD,CMPSN:1.5K OHM,10%,0.25W	01121	CB1521
R3212	315-0364-00			RES.,FXD,CMPSN:360K OHM,5%,0.25W	01121	CB3645
R3215	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R3218	316-0681-00			RES.,FXD,CMPSN:680 OHM,10%,0.25W	01121	CB6811
R3220	308-0643-00			RES.,FXD,WW:0.1 OHM,3%,3W	91637	RS2B-ER1000H
R3221	315-0750-00			RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R3223	315-0112-00			RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	01121	CB1125
R3226	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R3227	321-0356-00			RES.,FXD,FILM:49.9K OHM,1%,0.125W	75042	CEAT0-4992F
R3229	316-0274-00			RES.,FXD,CMPSN:270K OHM,10%,0.25W	01121	CB2741
R3236	304-0150-00			RES.,FXD,CMPSN:15 OHM,10%,1W	01121	GB1501
R3239	302-0181-00			RES.,FXD,CMPSN:180 OHM,10%,0.50W	01121	EB1811
R3240	307-0115-00			RES.,FXD,CMPSN:7.5 OHM,5%,0.25W	01121	CB75G5
R3242	316-0183-00			RES.,FXD,CMPSN:18K OHM,10%,0.25W	01121	CB1831
R3243	316-0471-00			RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
R3244	316-0101-00			RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
R3245	316-0332-00			RES.,FXD,CMPSN:3.3K OHM,10%,0.25W	01121	CB3321
R3247	321-0996-03			RES.,FXD,FILM:99K OHM,0.25%,0.125W	91637	MFF1816D99001C
R3248	323-0800-03			RES.,FXD,FILM:732K OHM,0.25%,0.50W	91637	MFF1226D73202C
R3249	304-0100-00			RES.,FXD,CMPSN:10 OHM,10%,1W	01121	GB1001
R3355	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R3357	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R3359	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R3368	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3369	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R3376	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R3378	315-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R3379	315-0133-00			RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
R3381	315-0133-00			RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
R3383	315-0753-00			RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
R3384	321-0308-00			RES.,FXD,FILM:15.8K OHM,1%,0.125W	75042	CEAT0-1582F
R3386	315-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R3387	321-0319-00			RES.,FXD,FILM:20.5K OHM,1%,0.125W	75042	CEAT0-2052F
R3389	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R3390	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R3391	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R3393	321-0344-00			RES.,FXD,FILM:37.4K OHM,1%,0.125W	75042	CEAT0-3742F
R3394	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R3396	315-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R3397	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R3398	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R3399	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R3401	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R3402	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R3403	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R3404	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035

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R3405	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R3406	315-0124-00			RES.,FXD,CMPSN:120K OHM,5%,0.25W	01121	CB1245
R3407	311-1224-00			RES.,VAR,NONWIR:500 OHM,20%,0.50W	80294	3386F-T04-501
R3408	321-0300-00			RES.,FXD,FILM:13K OHM,1%,0.125W	75042	CEAT0-1302F
R3409	321-0259-00			RES.,FXD,FILM:4.87K OHM,1%,0.125W	12697	MFF1816G48700F
R3410	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	75042	CEAT0-7500F
R3411	321-0297-00			RES.,FXD,FILM:12.1K OHM,1%,0.125W	75042	CEAT0-1212F
R3412	321-0212-00			RES.,FXD,FILM:1.58K OHM,1%,0.125W	75042	CEAT0-1581F
R3414	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3416	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R3418	321-0268-00			RES.,FXD,FILM:6.04K OHM,1%,0.125W	75042	CEAT0-6041F
R3419	321-0322-00			RES.,FXD,FILM:22.1K OHM,1%,0.125W	75042	CEAT0-2212F
R3420	321-0262-00			RES.,FXD,FILM:5.23K OHM,1%,0.125W	75042	CEAT0-5231F
R3422	311-1224-00			RES.,VAR,NONWIR:500 OHM,20%,0.50W	80294	3386F-T04-501
R3423	321-0372-00			RES.,FXD,FILM:73.2K OHM,1%,0.125W	75042	CEAT0-7322F
R3425	321-0403-00			RES.,FXD,FILM:154K OHM,1%,0.125W	75042	CEAT0-1543F
R3427	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3430	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R3431	315-0683-00			RES.,FXD,CMPSN:68K OHM,5%,0.25W	01121	CB6835
R3432	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3433	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R3434	315-0393-00			RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R3435	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R3436	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R3437	311-1225-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	80294	3386F-T04-102
R3438	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R3439	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3440	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R3441	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R3442	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R3445	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3447	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R3449	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R3450	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3451	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3452	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3466	321-0153-00			RES.,FXD,FILM:383 OHM,1%,0.125W	75042	CEAT0-3830F
R3468	321-0191-00			RES.,FXD,FILM:953 OHM,1%,0.125W	75042	CEAT0-9530F
R3470	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3472	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3473	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R3474	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R3475	315-0912-00			RES.,FXD,CMPSN:9.1K OHM,5%,0.25W	01121	CB9125
R3476	321-0296-00			RES.,FXD,FILM:11.8K OHM,1%,0.125W	75042	CEAT0-1182F
R3477	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R3478	315-0753-00			RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
R3479	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R3480	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R3481	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R3482	321-0250-00			RES.,FXD,FILM:3.92K OHM,1%,0.125W	75042	CEAT0-3921F
R3483	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R3484	321-0216-00			RES.,FXD,FILM:1.74K OHM,1%,0.125W	75042	CEAT0-1741F
R3485	321-0245-00			RES.,FXD,FILM:3.48K OHM,1%,0.125W	75042	CEAT0-3481F

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R3486	321-0199-00			RES.,FXD,FILM:1.15K OHM,1%,0.125W	75042	CEAT0-1151F
R3487	321-0273-00			RES.,FXD,FILM:6.81K OHM,1%,0.125W	75042	CEAT0-6811F
R3488	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R3489	321-0209-00			RES.,FXD,FILM:1.47K OHM,1%,0.125W	75042	CEAT0-1471F
R3490	311-1225-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	80294	3386F-T04-102
R3491	321-0204-00			RES.,FXD,FILM:1.3K OHM,1%,0.125W	75042	CEAT0-1301F
R3492	321-0245-00			RES.,FXD,FILM:3.48K OHM,1%,0.125W	75042	CEAT0-3481F
R3493	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3494	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R3497	321-0241-00			RES.,FXD,FILM:3.16K OHM,1%,0.125W	75042	CEAT0-3161F
R3498	321-0255-00			RES.,FXD,FILM:4.42K OHM,1%,0.125W	75042	CEAT0-4421F
R3499	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3502	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3513	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R3514	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R3519	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R3520	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R3803	315-0510-00	XB130000		RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R3804	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R3805	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R4401[1]	315-0510-00	XB130000		RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R4402[1]	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R4403[1]	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R4404[1]	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R4405[1]	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R4406[1]	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R4407[1]	311-1261-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	80294	3329P-L58-501
R4408[1]	315-0133-00			RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
R4409[1]	321-0259-00			RES.,FXD,FILM:4.87K OHM,1%,0.125W	12697	MFF1816G48700F
R4410[1]	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R4411[1]	321-0297-00			RES.,FXD,FILM:12.1K OHM,1%,0.125W	75042	CEAT0-1212F
R4412[1]	321-0212-00			RES.,FXD,FILM:1.58K OHM,1%,0.125W	75042	CEAT0-1581F
R4414[1]	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R4416[1]	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R4417[1]	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R4419[1]	321-0322-00			RES.,FXD,FILM:22.1K OHM,1%,0.125W	75042	CEAT0-2212F
R4420[1]	321-0262-00			RES.,FXD,FILM:5.23K OHM,1%,0.125W	75042	CEAT0-5231F
R4422[1]	311-1261-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	80294	3329P-L58-501
R4423[1]	321-0372-00			RES.,FXD,FILM:73.2K OHM,1%,0.125W	75042	CEAT0-7322F
R4425[1]	321-0403-00			RES.,FXD,FILM:154K OHM,1%,0.125W	75042	CEAT0-1543F
R4427[1]	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4430[1]	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R4431[1]	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R4433[1]	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R4434[1]	315-0393-00			RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R4438[1]	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R4439[1]	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R4441[1]	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R4442[1]	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R4475[1]	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R4477[1]	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R4484[1]	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4485[1]	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725

[1]Option 20 only

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R4494[1]	321-0285-00			RES.,FXD,FILM:9.09K OHM,1%,0.125W	75042	CEAT0-9091F
R4495[1]	321-0268-00			RES.,FXD,FILM:6.04K OHM,1%,0.125W	75042	CEAT0-6041F
R4496[1]	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R4497[1]	303-0360-00			RES.,FXD,CMPSN:36 OHM,5%,1W	01121	GB3605
R4498[1]	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R4499[1]	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R4501	321-0122-00	XB090000		RES.,FXD,FILM:182 OHM,1%,0.125W	75042	CEAT0-1820F
R4502	321-0026-00	XB090000		RES.,FXD,FILM:18.2 OHM,1%,0.125W	75042	CEAT0-18R20F
R4503	321-0068-00	XB090000		RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R4504	321-0137-00	XB090000		RES.,FXD,FILM:261 OHM,1%,0.125W	75042	CEAT0-2610F
R4505	323-0144-00	XB090000		RES.,FXD,FILM:309 OHM,1%,0.50W	75042	CECT0-3090F
R4506	321-0137-00	XB090000		RES.,FXD,FILM:261 OHM,1%,0.125W	75042	CEAT0-2610F
R4507	321-0122-00	XB090000		RES.,FXD,FILM:182 OHM,1%,0.125W	75042	CEAT0-1820F
R4508	321-0026-00	XB090000		RES.,FXD,FILM:18.2 OHM,1%,0.125W	75042	CEAT0-18R20F
R4509	321-0068-00	XB090000		RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R4531	315-0201-00	XB090000		RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R4532	315-0301-00	XB090000		RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R4541	315-0104-00	XB090000		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R4542	315-0104-00	XB090000		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R4551	317-0390-00	XB090000		RES.,FXD,CMPSN:39 OHM,5%,0.125W	01121	BB3905
R4552	321-0076-00	XB090000		RES.,FXD,FILM:60.4 OHM,1%,0.125W	75042	CEAT0-60R40F
R4553	323-0127-00	XB090000		RES.,FXD,FILM:205 OHM,1%,0.50W	75042	CECT0-2050F
R4554	321-0076-00	XB090000		RES.,FXD,FILM:60.4 OHM,1%,0.125W	75042	CEAT0-60R40F
R4555	317-0390-00	XB090000		RES.,FXD,CMPSN:39 OHM,5%,0.125W	01121	BB3905
R4561	321-0107-00	XB090000		RES.,FXD,FILM:127 OHM,1%,0.125W	75042	CEAT0-1270F
R4562	321-0148-00	XB090000		RES.,FXD,FILM:340 OHM,1%,0.125W	75042	CEAT0-3400F
R4563	311-1277-00	XB090000		RES.,VAR,NONWIR:100 OHM,10%,0.5W	73138	62PAS-326-0
R4564	321-0148-00	XB090000		RES.,FXD,FILM:340 OHM,1%,0.125W	75042	CEAT0-3400F
R4571	317-0131-00	XB090000		RES.,FXD,CMPSN:130 OHM,5%,0.125W	01121	BB1315
R4572	323-0181-00	XB090000		RES.,FXD,FILM:750 OHM,1%,0.50W	75042	CECT0-7500F
R4574	323-0181-00	XB090000		RES.,FXD,FILM:750 OHM,1%,0.50W	75042	CECT0-7500F
R4575	317-0131-00	XB090000		RES.,FXD,CMPSN:130 OHM,5%,0.125W	01121	BB1315
R4588	321-0072-00	XB090000		RES.,FXD,FILM:54.9 OHM,1%,0.125W	75042	CEAT0-54R90F
R4589	321-0072-00	XB090000		RES.,FXD,FILM:54.9 OHM,1%,0.125W	75042	CEAT0-54R90F
R4602	325-0044-00	XB140000		RES.,FXD,FILM:100 OHM,0.5%,0.05W	03888	PME50T1-1000D
R4603	325-0114-00	XB140000		RES.,FXD,FILM:105 OHM,(NOM VALUE),SEL	14298	ACE50-G105R0D
R4605	323-0134-00	XB140000		RES.,FXD,FILM:243 OHM,1%,0.50W	91637	MFF1226G243R0F
R4607	321-0126-00	XB140000		RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R4608	321-0126-00	XB140000		RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R4610	315-0621-00	XB140000		RES.,FXD,CMPSN:620 OHM,(NOM VALUE),SEL	01121	CB6215
R4611	315-0561-00	XB140000		RES.,FXD,CMPSN:560 OHM,(NOM VALUE),SEL	01121	CB5615
R4613	323-0134-00	XB140000		RES.,FXD,FILM:243 OHM,1%,0.50W	91637	MFF1226G243R0F
R4615	321-0126-00	XB140000		RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R4616	321-0126-00	XB140000		RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R4620	325-0114-00	XB140000		RES.,FXD,FILM:105 OHM,(NOM VALUE),SEL	14298	ACE50-G105R0D
R4621	325-0044-00	XB140000		RES.,FXD,FILM:100 OHM,0.5%,0.05W	03888	PME50T1-1000D
R4623	315-0102-00	XB140000		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4625	325-0044-00	XB140000		RES.,FXD,FILM:100 OHM,0.5%,0.05W	03888	PME50T1-1000D
R4627	325-0044-00	XB140000		RES.,FXD,FILM:100 OHM,0.5%,0.05W	03888	PME50T1-1000D
R4630	321-0097-00	XB140000		RES.,FXD,FILM:100 OHM,1%,0.125W	75042	CEAT0-1000F
R4632	315-0301-00	XB140000		RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R4634	315-0121-00	XB140000		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
R4636	315-0132-00	XB140000		RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325

[1]Option 20 only

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R4638	315-0121-00	XB140000		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
R4640	315-0511-00	XB140000		RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R4642	315-0132-00	XB140000		RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325
R4643	315-0181-00	XB140000		RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R4645	315-0121-00	XB140000		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
R4647	315-0132-00	XB140000		RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325
R4649	315-0121-00	XB140000		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
R4650	315-0102-00	XB140000		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4652	315-0161-00	XB140000		RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R4656	315-0362-00	XB140000		RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R4657	315-0102-00	XB140000		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4662	325-0044-00	XB140000		RES.,FXD,FILM:100 OHM,0.5%,0.05W	03888	PME50T1-1000D
R4663	325-0114-00	XB140000		RES.,FXD,FILM:105 OHM,(NOM VALUE),SEL	14298	ACE50-G105R0D
R4665	323-0134-00	XB140000		RES.,FXD,FILM:243 OHM,1%,0.50W	91637	MFF1226G243R0F
R4667	321-0126-00	XB140000		RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R4668	321-0126-00	XB140000		RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R4673	323-0134-00	XB140000		RES.,FXD,FILM:243 OHM,1%,0.50W	91637	MFF1226G243R0F
R4675	321-0126-00	XB140000		RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R4676	321-0126-00	XB140000		RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R4677	315-0621-00	XB140000		RES.,FXD,CMPSN:620 OHM,(NOM VALUE),SEL	01121	CB6215
R4678	315-0561-00	XB140000		RES.,FXD,CMPSN:560 OHM,(NOM VALUE),SEL	01121	CB5615
R4680	325-0114-00	XB140000		RES.,FXD,FILM:105 OHM,(NOM VALUE),SEL	14298	ACE50-G105R0D
R4681	325-0044-00	XB140000		RES.,FXD,FILM:100 OHM,0.5%,0.05W	03888	PME50T1-1000D
R4683	315-0102-00	XB140000		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4685	325-0044-00	XB140000		RES.,FXD,FILM:100 OHM,0.5%,0.05W	03888	PME50T1-1000D
R4687	325-0044-00	XB140000		RES.,FXD,FILM:100 OHM,0.5%,0.05W	03888	PME50T1-1000D
R4689	SELECTED	XB140000				
RT731	307-0364-00			RES.,THERMAL:50 OHM,5%,0.125W	01295	TG1-8-50J
RT1209	307-0350-00	B010100	B030211	RES.,THERMAL:7.5 OHM,10%,3.9%/DEG C	15454	75DJ7R5R0220SS
RT1209	307-0353-00	B030212		RES.,FXD,FILM::5 OHM,10%,DISC	15454	5DA5R0-K-270SS
RT1213	307-0353-00	XB030212		RES.,FXD,FILM::5 OHM,10%,DISC	15454	5DA5R0-K-27055
S235	260-1445-00	B010100	B010101X	SWITCH,PUSH:	80009	260-1445-00
S243	260-1445-00	XB010102		SWITCH,PUSH:	80009	260-1445-00
S255	670-2479-00			SWITCH,PUSH:OPERATING MODE	80009	670-2479-00
S256[1]	311-1569-00			RES.,VAR,NONWIR:250 K OHM,20%,1W	01121	11M616
S259[2]	311-1578-00			RES.,VAR,NONWIR:25 X 25 K OHM,2%,0.5W	01121	11M706
S275	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	79727	GF126-0028
S1201	260-0336-00			SW,THERMOSTATIC:SPST,8.3A AT 120 VAC	81439	36T21S-3778
S1203	260-1300-02			SWITCH,SLIDE:POWER ON	82389	11A-1389
S1212	260-1553-00			SWITCH,SLIDE:LINE VOLTAGE SELECTOR	82389	47227
S2295	260-0723-00	B010100	B010111X	SWITCH,SLIDE:DPDT,0.5A,125VAC	79727	GF126-0028
T1202	120-0893-00			XFMR,PWR,STPDN:	80009	120-0893-00
T1208	120-0636-00			XFMR,PWR,STPDN:PRI 2.625V,SEC 1V,0.005A	80009	120-0636-00
T1225	120-0743-00			XFMR,TOROID:13 TURNS,BIFILAR	80009	120-0743-00
T1230	120-0744-00			XFMR,TOROID:5 WINDINGS	80009	120-0744-00
T1235	120-0747-00			XFMR,TOROID:55 TURNS,SINGLE	80009	120-0747-00
T1310	120-0890-00			XFMR,POWER:	80009	120-0890-00
T1633	120-0892-00			XFMR,HV:	80009	120-0892-00
T1732	120-0891-00			XFMR,FILAMENT:	80009	120-0891-00
U30	155-0011-00			MICROCIRCUIT,DI:ML,CLOCK AND CHOP BLANKING	80009	155-0011-00
U40	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U125	155-0012-00			MICROCIRCUIT,LI:ML,Z-AXIS AND AMPLIFIER	80009	155-0012-00

[1]Furnished as a unit with R1620
[2]Furnished as a unit with R259 and R2450

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U152	156-0143-00			MICROCIRCUIT,DI:RETRIGGERABLE MONOST/MV	01295	SN74122N
U300	156-0124-00			MICROCIRCUIT,DI:SGL FREQ/PHASE DETECTOR	04713	MC4044P
U310	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-0067-00
U320	156-0047-00			MICROCIRCUIT,DI:3-INPUT NAND GATE	80009	156-0047-00
U325	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U395	156-0068-00			MICROCIRCUIT,LI:FIVE TRANSISTOR ARRAY	86684	80364
U415	156-0068-00			MICROCIRCUIT,LI:FIVE TRANSISTOR ARRAY	86684	80364
U425	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U440	156-0124-00			MICROCIRCUIT,DI:SGL FREQ/PHASE DETECTOR	04713	MC4044P
U450	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-0067-00
U465	156-0047-00			MICROCIRCUIT,DI:3-INPUT NAND GATE	80009	156-0047-00
U470	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U545	156-0068-00			MICROCIRCUIT,LI:FIVE TRANSISTOR ARRAY	86684	80364
U565	156-0068-00			MICROCIRCUIT,LI:FIVE TRANSISTOR ARRAY	86684	80364
U575	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U625[1]	155-0060-00	B010100	B139999X	MICROCIRCUIT,DI:ML,VERT CHANNEL SWITCH	80009	155-0060-00
U685	155-0059-00			MICROCIRCUIT,LI:ML,HIGH FREQUENCY AMPL	80009	155-0059-00
U745	155-0065-00			MICROCIRCUIT,LI:ML,OUT AMPLIFIER	80009	155-0065-00
U825	155-0022-00			MICROCIRCUIT,DI:A AND B LOGIC ML CHAN SW	80009	155-0022-00
U1275	155-0067-02			MICROCIRCUIT,DI:ML,POWER SUPPLY REGULATOR	80009	155-0067-02
U1605	156-0223-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	12040	LM308H
U1768	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U1770	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U1831	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-0067-00
U1871	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U1892	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-0067-00
U1983	156-0068-00			MICROCIRCUIT,LI:FIVE TRANSISTOR ARRAY	86684	80364
U2138	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U2178	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U2190	156-0048-00			MICROCIRCUIT,LI:FIVE NPN TRANSISTOR ARRAY	86684	CA3046
U2208	156-0049-00			MICROCIRCUIT,LI:OPERATING AMPLIFIER	07263	U5B7741393
U2275	156-0048-00			MICROCIRCUIT,LI:FIVE NPN TRANSISTOR ARRAY	86684	CA3046
U2296	156-0030-00	XB010112		MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2300	156-0041-00	XB010112		MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U2304	156-0405-00	B010100	B010111X	MICROCIRCUIT,DI:DUAL RETRIG MONOSTABLE MV	07263	9602PC
U2312	156-0072-00	B010100	B010111X	MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2315	156-0405-00	XB010112		MICROCIRCUIT,DI:DUAL RETRIG MONOSTABLE MV	07263	9602PC
U2317	156-0072-00	B010100	B010111X	MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2345	156-0355-00			MICROCIRCUIT,LI:SEVEN TRANSISTOR ARRAY	86684	CA3081
U2410	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U2404	156-0202-00	B010100	B010141X	MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2412	156-0047-00	B010100	B010141	MICROCIRCUIT,DI:3-INPUT NAND GATE	80009	156-0047-00
U2412	156-0202-00	B010142		MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2414	156-0030-00	B010100	B010141X	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2416	156-0047-00	XB010142		MICROCIRCUIT,DI:3-INPUT NAND GATE	80009	156-0047-00
U2417	156-0072-00	B010100	B010141X	MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2418	156-0030-00	XB010142		MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2419	156-0072-00	XB010142		MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2420	156-0202-00	B010100	B010141X	MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2421	156-0202-00	XB010142		MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2422	156-0202-00	B010100	B010141X	MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2423	156-0202-00	XB010142		MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2424	156-0072-00	B010100	B010141X	MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N

[1]For replacement order 670-1625-01 or 670-1625-02

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U2425	156-0072-00	XB010142		MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2426	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2430	156-0202-00			MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2432	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2434	155-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	80009	155-0041-00
U2436	156-0039-00			MICROCIRCUIT,DI:DUAL J-K FLIP FLOP	01295	SN7473N
U2438	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2458	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2460	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2464	156-0202-00			MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2466	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2478	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U2492	156-0124-00			MICROCIRCUIT,DI:SGL FREQ/PHASE DETECTOR	04713	MC4044P
U2502	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-0067-00
U2706	156-0177-00			MICROCIRCUIT,DI:DUAL LINE RECEIVER	01295	SN75107AN
U2708	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2710	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2712	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2714	156-0143-00			MICROCIRCUIT,DI:RETRIGGERABLE MONOST/MV	01295	SN74122N
U2716	156-0124-00			MICROCIRCUIT,DI:SGL FREQ/PHASE DETECTOR	04713	MC4044P
U2725	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-0067-00
U2730	156-0121-00			MICROCIRCUIT,DI:DUAL V-CONT,MV	80009	156-0121-00
U2732	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2738	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2741	156-0202-00			MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2743[1]	131-1393-00			CONN,PROGRAMMED:	80009	131-1393-00
U2743[1]	131-1394-00			CONN,PROGRAMMED:	80009	131-1394-00
U2745	156-0202-00			MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2747	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2749	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2751	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U2753	156-0202-00			MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2755[1]	131-1395-00			CONN,PROGRAMMED:	80009	131-1395-00
U2755[1]	131-1396-00			CONN,PROGRAMMED:	80009	131-1396-00
U2757	156-0202-00			MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2759	156-0202-00			MICROCIRCUIT,DI:HEXADECIMAL COUNTER	04713	MC4018P
U2762	156-0143-00			MICROCIRCUIT,DI:RETRIGGERABLE MONOST/MV	01295	SN74122N
U2764	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2765	156-0079-00			MICROCIRCUIT,DI:DECADE COUNTER,TTL	07263	9390PC
U2767	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U2769	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U2771	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2773	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2783	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2786	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2801	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2803	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2805	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2807	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2811	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2814	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2816	156-0041-00	XB010142		MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U2817	156-0058-00			MICROCIRCUIT,DI:HEX INVERTER	01295	SN7404N

[1]Option 13 only

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U2818	156-0072-00	XB010142		MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2820	131-1392-00	B010100	B019999	CONN,PROGRAMMED:	80009	131-1392-00
U2820	131-1659-00	B020000		CONN,PROGRAMMED:	80009	131-1659-00
U2822	156-0034-00			MICROCIRCUIT,DI:DUAL 4-INPUT NAND GATE	80009	156-0034-00
U2825	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2828	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2830	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2833	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2835	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U2838	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U2841	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U2844	156-0125-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN74157N
U2847	156-0040-00			MICROCIRCUIT,DI:QUAD LATCH,TTL	80009	156-0040-00
U2850	156-0125-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN74157N
U2852	156-0040-00			MICROCIRCUIT,DI:QUAD LATCH,TTL	80009	156-0040-00
U2854	156-0125-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN74157N
U2857	156-0040-00			MICROCIRCUIT,DI:QUAD LATCH,TTL	80009	156-0040-00
U2860	131-1391-00	B010100	B019999	CONN,PROGRAMMED:	80009	131-1391-00
U2860	131-1660-00	B020000		CONN,PROGRAMMED:	80009	131-1660-00
U2865	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2867	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U2869	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U2871	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U2874	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2877	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2879	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2884	156-0125-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN74157N
U2902	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2906	156-0058-00			MICROCIRCUIT,DI:HEX INVERTER	01295	SN7404N
U2912	156-0047-00	B010100	B010111	MICROCIRCUIT,DI:3-INPUT NAND GATE	80009	156-0047-00
U2912	156-0030-00	B010112		MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2916	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2918	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2919	156-0047-00			MICROCIRCUIT,DI:3-INPUT NAND GATE	80009	156-0047-00
U2923	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2926	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2928	156-0057-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	07263	7401PC
U2933	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2937	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2939	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2942	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL	27014	DM74121N
U2945	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U2947	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U2949	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U2951	156-0123-00			MICROCIRCUIT,LI:4-BIT MAGNITUDE COMPARATOR	01295	SN7485N
U2953	156-0123-00			MICROCIRCUIT,LI:4-BIT MAGNITUDE COMPARATOR	01295	SN7485N
U2955	156-0123-00			MICROCIRCUIT,LI:4-BIT MAGNITUDE COMPARATOR	01295	SN7485N
U2961	156-0089-00			MICROCIRCUIT,DI:4-BIT UP/DOWN COUNTER	80009	156-0089-00
U2963	156-0089-00			MICROCIRCUIT,DI:4-BIT UP/DOWN COUNTER	80009	156-0089-00
U2965	156-0089-00			MICROCIRCUIT,DI:4-BIT UP/DOWN COUNTER	80009	156-0089-00
U2967	156-0089-00			MICROCIRCUIT,DI:4-BIT UP/DOWN COUNTER	80009	156-0089-00
U2970	156-0058-00			MICROCIRCUIT,DI:HEX INVERTER	01295	SN7404N
U2972	156-0058-00			MICROCIRCUIT,DI:HEX INVERTER	01295	SN7404N

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U2975	156-0061-00			MICROCIRCUIT,DI:SGL,BCD TO DEC DECODER	01295	SN7442N
U3001	156-0396-00	B010100	B010141	MICROCIRCUIT,DI:QUAD 2-INPUT TRI-STATE BFR	27014	DM8094N
U3001	156-0145-00	B010142		MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U3003	156-0396-00	B010100	B010141	MICROCIRCUIT,DI:QUAD 2-INPUT TRI-STATE BFR	27014	DM8094N
U3003	156-0030-00	B010142		MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U3005	156-0396-00	B010100	B010141	MICROCIRCUIT,DI:QUAD 2-INPUT TRI-STATE BFR	27014	DM8094N
U3005	156-0030-00	B010142		MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U3007	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3009	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3011	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3013	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3015	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3017	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3019	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3021	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3023	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3025	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3027	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3029	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3031	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3033	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3035	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3037	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3039	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3041	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3043	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3045	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3047	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3049	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3051	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3053	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3055	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3057	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3059	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3061	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3063	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3065	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3067	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3069	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3071	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3073	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3075	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3077	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3079	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3081	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3083	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3085	156-0291-00			MICROCIRCUIT,DI:1024 BIT X STATIC ROM	34649	2102
U3091	156-0396-00	B010100	B010141	MICROCIRCUIT,DI:QUAD 2-INPUT TRI-STATE BFR	27014	DM8094N
U3091	156-0145-00	B010142		MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U3093	156-0396-00	B010100	B010141	MICROCIRCUIT,DI:QUAD 2-INPUT TRI-STATE BFR	27014	DM8094N
U3093	156-0145-00	B010142		MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U3208	156-0048-00			MICROCIRCUIT,LI:FIVE NPN TRANSISTOR ARRAY	86684	CA3046
U3362	155-0015-01			MICROCIRCUIT,DI:ML,ANALOG DATA SWITCH	80009	155-0015-01

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U3372	155-0015-01			MICROCIRCUIT,DI:ML,ANALOG DATA SWITCH	80009	155-0015-01
U3401	155-0018-00			MICROCIRCUIT,DI:ZERO LOGIC	80009	155-0018-00
U3418	155-0014-01			MICROCIRCUIT,DI:ML,ANALOG TO DECIMAL CONV	80009	155-0014-01
U3429	155-0014-01			MICROCIRCUIT,DI:ML,ANALOG TO DECIMAL CONV	80009	155-0014-01
U3433	155-0021-00			MICROCIRCUIT,DI:ML,TIMING GENERATOR	80009	155-0021-00
U3445	155-0017-00			MICROCIRCUIT,DI:ML,ZERO LOGIC COUNTER	80009	155-0017-00
U3447	156-0043-00			MICROCIRCUIT,DI:2-INPUT NOR GATE	80009	156-0043-00
U3449	156-0043-00			MICROCIRCUIT,DI:2-INPUT NOR GATE	80009	156-0043-00
U3450	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U3461	155-0023-00			MICROCIRCUIT,DI:ML,CHAR GEN NUMERALS	80009	155-0023-00
U3463	155-0024-00			MICROCIRCUIT,DI:ML,CHAR GEN SPCL SYMBOLS	80009	155-0024-00
U3465	155-0025-00			MICROCIRCUIT,DI:ML,CHAR GEN PREFIXES	80009	155-0025-00
U3467	155-0026-00			MICROCIRCUIT,DI:ML,CHAR GEN LETTERS	80009	155-0026-00
U3469	155-0027-00			MICROCIRCUIT,DI:ML,CHAR GEN SPCL ALPHA	80009	155-0027-00
U3470	155-0019-00			MICROCIRCUIT,DI:ML,DECIMAL POINT AND SPACE	80009	155-0019-00
U3480	155-0020-00			MICROCIRCUIT,DI:ML,CHANNEL SW OUTPUT ASSY	80009	155-0020-00
U3510	131-1390-00	B010100	B010141	CONN,PROGRAMMED:	80009	131-1390-00
U3510	131-1390-01	B010142	B039999	CONN,PROGRAMMED:	80009	131-1390-01
U3510	131-1390-02	B040000		CONN,PROGRAMMED:	80009	131-1390-02
U4401[1]	155-0018-00			MICROCIRCUIT,DI:ZERO LOGIC	80009	155-0018-00
U4418[1]	155-0014-01			MICROCIRCUIT,DI:ML,ANALOG TO DECIMAL CONV	80009	155-0014-01
U4429[1]	155-0014-01			MICROCIRCUIT,DI:ML,ANALOG TO DECIMAL CONV	80009	155-0014-01
U4433[1]	155-0021-01			MICROCIRCUIT,DI:ML,TIMING GENERATOR	80009	155-0021-01
U4445[1]	155-0017-00			MICROCIRCUIT,DI:ML,ZERO LOGIC COUNTER	80009	155-0017-00
U4449[1]	307-0387-00			RES.,FXD,FILM:13 RES.NETWORK,8200 OHM	73138	899-1-R8.2K
U4451[1]	156-0219-00			MICROCIRCUIT,DI:8-INPUT PRIORITY DCDR	07263	9318DC
U4453[1]	307-0387-00			RES.,FXD,FILM:13 RES.NETWORK,8200 OHM	73138	899-1-R8.2K
U4455[1]	156-0347-00			MICROCIRCUIT,DI:10-LINE TO 4-LINE ENCODER	01295	SN74147N
U4457[1]	156-0346-00			MICROCIRCUIT,DI:ROM,KRO ASC11 CONV	34649	1301-0155
U4459[1]	307-0387-00			RES.,FXD,FILM:13 RES.NETWORK,8200 OHM	73138	899-1-R8.2K
U4461[1]	156-0146-00			MICROCIRCUIT,DI:8-BIT SHIFT REGISTER	01295	SN74165N
U4463[1]	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U4465[1]	156-0047-00			MICROCIRCUIT,DI:3-INPUT NAND GATE	80009	156-0047-00
U4467[1]	156-0043-00			MICROCIRCUIT,DI:2-INPUT NOR GATE	80009	156-0043-00
U4469[1]	156-0135-00			MICROCIRCUIT,DI:SINGLE 667 KHZ	34039	C1101A
U4471[1]	156-0131-00			MICROCIRCUIT,DI:8-BIT SER TO PARLLEL SHF	01295	SN74164N
U4473[1]	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U4474[1]	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U4476[1]	156-0405-00			MICROCIRCUIT,DI:DUAL RETRIG MONOSTABLE MV	07263	9602PC
U4478[1]	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U4480[1]	156-0383-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	01295	SN74LS02N
U4481[1]	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U4482[1]	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U4483[1]	156-0043-00			MICROCIRCUIT,DI:2-INPUT NOR GATE	80009	156-0043-00
U4485[1]	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN7493AN
U4486[1]	156-0062-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS EXCL GATE	04713	MC7486P
U4488[1]	156-0039-00			MICROCIRCUIT,DI:DUAL J-K FLIP FLOP	01295	SN7473N
U4489[1]	156-0042-00			MICROCIRCUIT,DI:J-K M/S FLIP-FLOP	01295	SN7476N
U4500	155-0078-05	XB090000		MICROCIRCUIT,LI:ML,VERT AMPL,SEL	80009	155-0078-05
U4625	155-0095-01	XB140000		MICROCIRCUIT,LI:FREQUENCY DIFF AMPLIFIER	80009	155-0095-01
U4641	155-0048-00	XB140000		MICROCIRCUIT,DI:TRIG AND SWEEP AMPLIFIER	80009	155-0048-00
U4685	155-0095-01	XB140000		MICROCIRCUIT,LI:FREQUENCY DIFF AMPLIFIER	80009	155-0095-01

[1] Option 20 only

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
V1730	154-0698-05			ELECTRON TUBE:CRT	80009	154-0698-05
VR251	152-0279-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	07910	1N751A
VR489	152-0226-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	81483	69-6584
VR597	152-0226-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	81483	69-6584
VR884	152-0306-00	B010100	B140501	SEMICOND DEVICE:ZENER,0.4W,9.1V,5%	81483	1N960B
VR884	152-0611-00	B140502		SEMICOND DEVICE:ZENER,0.4W,9V,2%	04713	SZ14347
VR894	152-0306-00	B010100	B140501	SEMICOND DEVICE:ZENER,0.4W,9.1V,5%	81483	1N960B
VR894	152-0611-00	B140502		SEMICOND DEVICE:ZENER,0.4W,9V,2%	04713	SZ14347
VR1114	152-0286-00			SEMICOND DEVICE:ZENER,0.4W,75V,5%	04713	1N982B
VR1117	152-0283-00			SEMICOND DEVICE:ZENER,0.4W,43V,5%	04713	1N976B
VR1134	152-0286-00			SEMICOND DEVICE:ZENER,0.4W,75V,5%	04713	1N982B
VR1137	152-0283-00			SEMICOND DEVICE:ZENER,0.4W,43V,5%	04713	1N976B
VR1164	152-0286-00			SEMICOND DEVICE:ZENER,0.4W,75V,5%	04713	1N982B
VR1167	152-0283-00			SEMICOND DEVICE:ZENER,0.4W,43V,5%	04713	1N976B
VR1184	152-0286-00			SEMICOND DEVICE:ZENER,0.4W,75V,5%	04713	1N982B
VR1187	152-0283-00			SEMICOND DEVICE:ZENER,0.4W,43V,5%	04713	1N976B
VR1246	152-0428-00			SEMICOND DEVICE:ZENER,0.4W,120V,5%	04713	1N987B
VR1253	152-0149-00			SEMICOND DEVICE:ZENER,0.4W,10V,5%	04713	1N961B
VR1279	152-0304-00			SEMICOND DEVICE:ZENER,0.4W,20V,5%	04713	1N968B
VR1297	152-0212-00			SEMICOND DEVICE:ZENER,0.5W,9V,5%	04713	SZ50646
VR1401	152-0226-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	81483	69-6584
VR1461	152-0226-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	81483	69-6584
VR1501	152-0127-00			SEMICOND DEVICE:ZENER,0.4W,7.5V,5%	04713	1N755A
VR1505	152-0212-00			SEMICOND DEVICE:ZENER,0.5W,9V,5%	04713	SZ50646
VR1680	152-0280-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	1N753A
VR1815	152-0456-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	1N827
VR2286	152-0280-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	1N753A
VR2586	152-0149-00			SEMICOND DEVICE:ZENER,0.4W,10V,5%	04713	1N961B
VR2726	152-0395-00	B010100	B090341X	SEMICOND DEVICE:ZENER,0.4W,4.3V,5%	07910	1N749A
VR2793	152-0149-00			SEMICOND DEVICE:ZENER,0.4W,10V,5%	04713	1N961B
VR3237	152-0022-00			SEMICOND DEVICE:ZENER,1W,25V,5%	04713	SZ12815
VR3470	152-0405-00			SEMICOND DEVICE:ZENER,1W,15V,5%	99942	1N5567B
VR3471	152-0405-00			SEMICOND DEVICE:ZENER,1W,15V,5%	99942	1N5567B
VR3472	152-0405-00			SEMICOND DEVICE:ZENER,1W,15V,5%	99942	1N5567B
Y2731	158-0085-00			XTAL UNIT,QTZ:5.003496 MHZ,+/-0.01%	80009	158-0085-00

DIAGRAMS

Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors =	Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
Resistors =	Ohms (Ω).

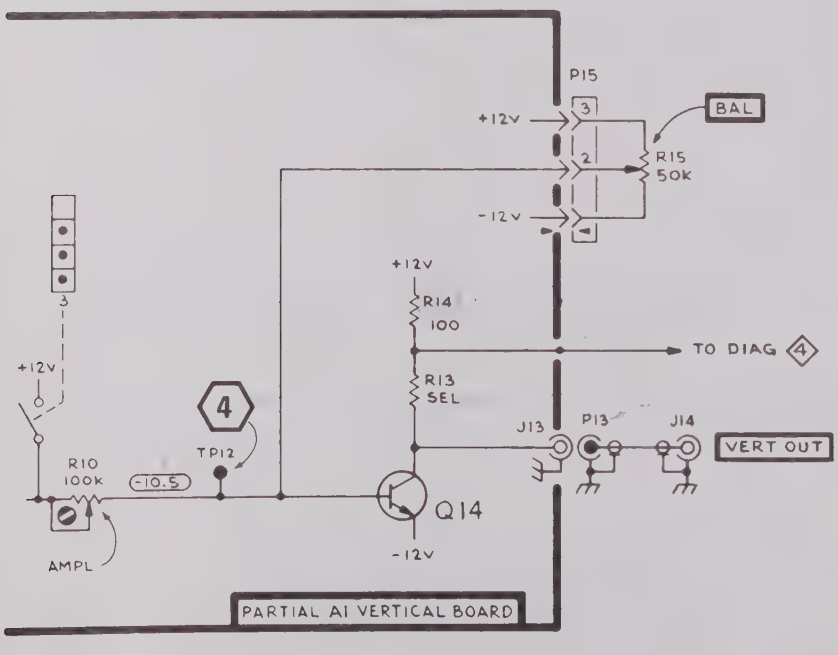
Symbols used on the diagrams are based on ANSI Standard Y32.2-1970.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)	H	Heat dissipating device (heat sink, heat radiator, etc.)	RT	Thermistor
AT	Attenuator, fixed or variable	HR	Heater	S	Switch
B	Motor	HY	Hybrid circuit	T	Transformer
BT	Battery	J	Connector, stationary portion	TC	Thermocouple
C	Capacitor, fixed or variable	K	Relay	TP	Test point
CB	Circuit breaker	L	Inductor, fixed or variable	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	V	Electron tube
DL	Delay line	M	Meter	VR	Voltage regulator (zener diode, etc.)
DS	Indicating device (lamp)	P	Connector, movable portion	Y	Crystal
E	Spark Gap	Q	Transistor or silicon-controlled rectifier	Z	Phase shifter
F	Fuse				
FL	Filter	R	Resistor, fixed or variable		

The following special symbols are used on the diagrams:



VERTICAL AMPLIFIER 2 CMD 1274

- Cam Switch Closure Chart
- Internal Screwdriver Adjustment
- Test Voltage
- Plug to E.C. Board
- Panel Adjustment
- Plug Index
- Modified Component—See Parts List
- Refer to Waveform
- Refer to Diagram Number
- SEL Value Selected at Factory
- Coaxial Connector
- Panel Connector
- Assembly Number
- Board Name
- Etched Circuit Board Outlined in Black
- Schematic Name and Number

@

VOLTAGE AND WAVEFORM CONDITIONS

WARNING

Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components. Some transistors have voltages present on their cases. Disconnect the power source before replacing parts.

The voltages and waveforms shown on this diagram can be obtained using the recommended test equipment listed below

RECOMMENDED TEST EQUIPMENT

Item	Specifications	Recommended Type
Oscilloscope	Frequency Response Dc to 100 MHz Deflection Factor .2 V to 20 V/div Input Impedance 1 MΩ, 20 pF	Tektronix 7603 equipped with 7A26 Amplifier and 7B-series time-base unit, or equivalent.
Probe	Fast rise 10X attenuation probe compatible with the vertical amplifier of the test oscilloscope.	P6105 or equivalent.
Precision dc voltmeter	Input Impedance 10 MΩ 0 –500 V	Tektronix DM 501 Digital Multimeter with TM 501 Power Module, or equivalent.

VOLTAGE MEASUREMENTS

Voltage measurements were obtained under the following conditions:

Set the OPERATING MODE switch to NON STORE.

Plug-in units are installed.

Voltmeter common is connected to chassis ground.

WAVEFORMS

Waveforms were obtained under the following conditions:

R7912 TRANSIENT DIGITIZER UNDER TEST. Front-panel controls are set the same as for voltage measurements except as may be noted on the waveform. Install a 7A19 amplifier unit in the vertical compartment and set the deflection factor to 0.1 volt/division. Install a 7B92A time-base unit in the horizontal compartment and set triggering to auto mode with ac coupling from the internal source. No signal is present on target.

TEST OSCILLOSCOPE. The test oscilloscope triggering is set to auto mode with ac coupling from the internal source except as may be noted on the waveform. The 7A26 input coupling is set to ac.

NOTE

The Linear Video Out and Binary Video Out waveforms on diagram 9 were obtained with the respective connectors terminated into 75 ohms.

NOTE

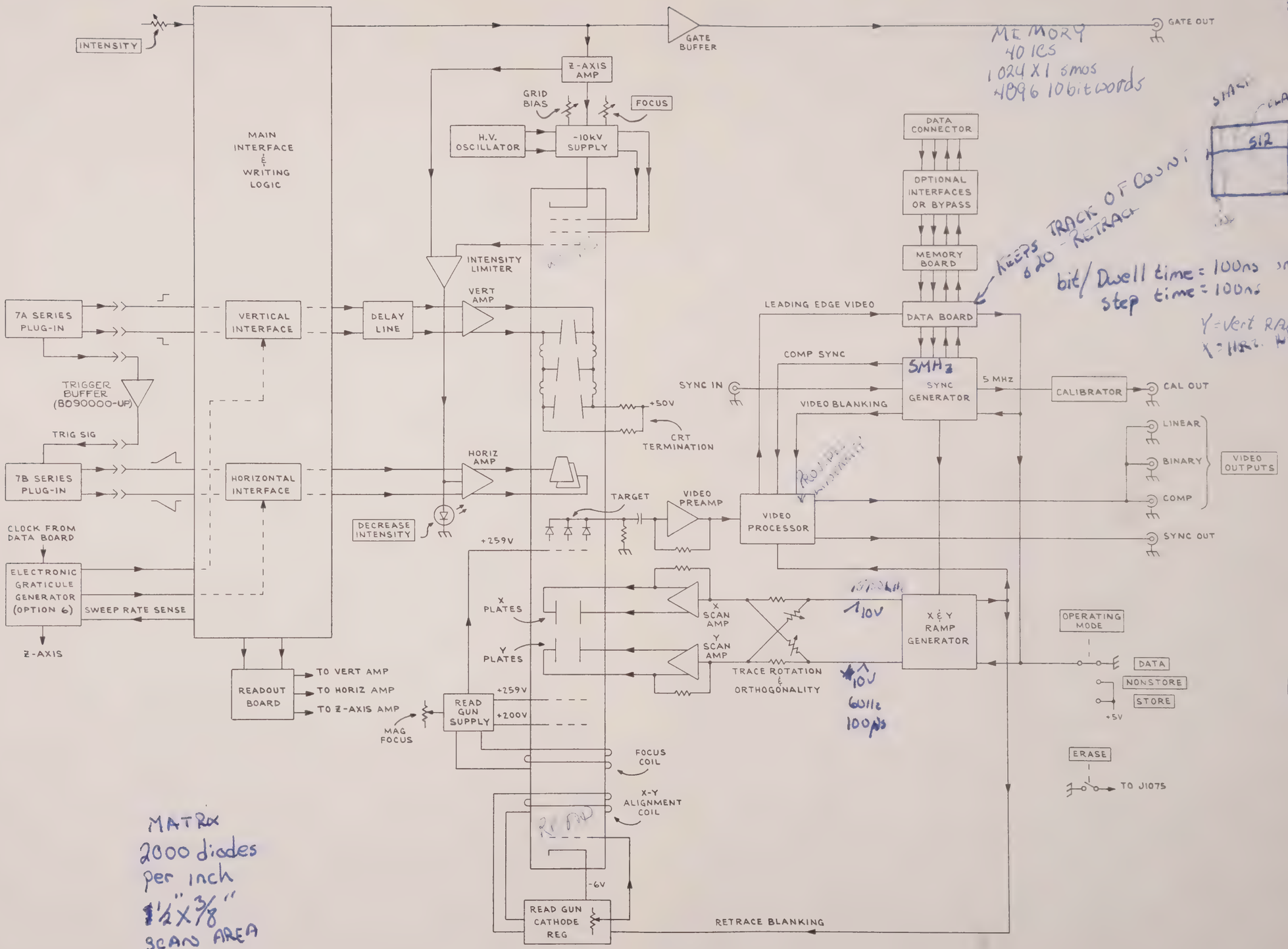
Voltages and waveforms are not absolute and may vary between instruments.

After YRAMP STEPS RETRACE OCCURS
Then x RAMP STEPS

4096
-512 HORZ
3581

512 | 3584
VERT STEPS

7 WORDS/LINE



MEMORY
40 ICS
1024 X 1 smos
4096 10 bit words

START
CLAMPING
512

KEEPS TRACK OF COUNT
520 - RETRACE

bit/ Dwell time = 100ns unless writing then 1.6μs
step time = 100ns

Y = Vert RAMP
X = HORZ. RAMP

10V

10V
60Hz
100μs

DDC = Digital Display Controller

MATRIX
2000 diodes per inch
1½" X 3/8"
SCAN AREA

R7912 @ BLOCK DIAGRAM NLL

BLOCK DIAGRAM

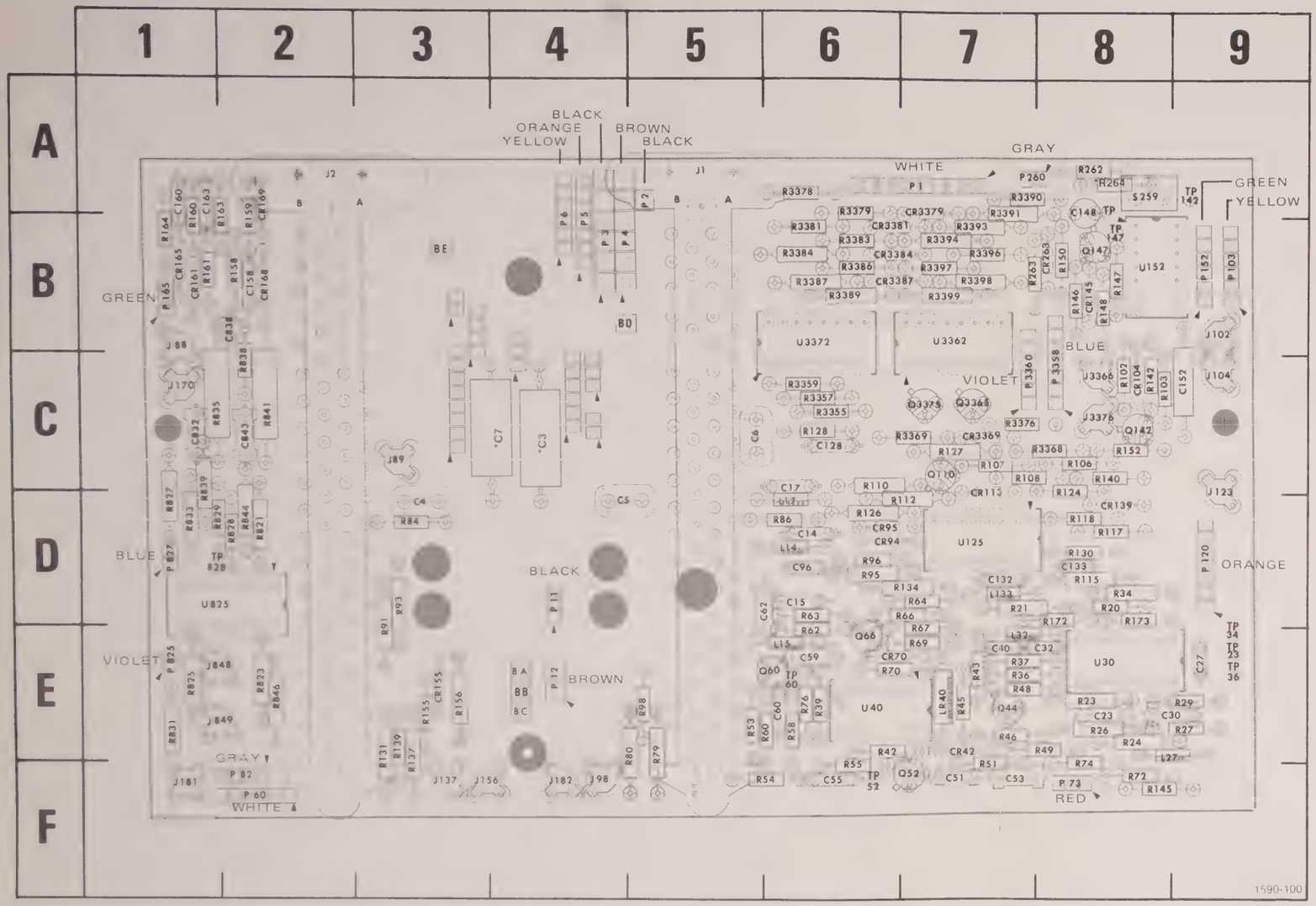


Fig. 8-1. A21—Main Interface & Partial Readout circuit board

CKT NO	GRID LOC
BA	E4
BB	E4
BC	E4
BE	B3
C3	C4
C4	D3
C6	C5
C7	C4
C14	D6
C15	D6
C17	C6
C23	E8
C27	E9
C30	E8
C32	E8
C40	E7
C51	F7
C53	F7
C59	E6
C60	E6
C62	D5
C96	D6
C128	C6
C132	D7
C133	D8
C148	A8
C152	C9
C158	B2
C160	A1
C163	A1
C832	C1
C843	C2
C838	B2
CR42	E7
CR70	E6
CR94	D6
CR95	D6
CR104	C8
CR113	C7
CR139	D8
CR145	B8
CR155	E3
CR161	B1
CR165	B1
CR168	B2
CR169	A2
CR263	B8
CR3369	C7
CR3379	A7
CR3381	B6
CR3384	B6
CR3387	B6
CS	D4

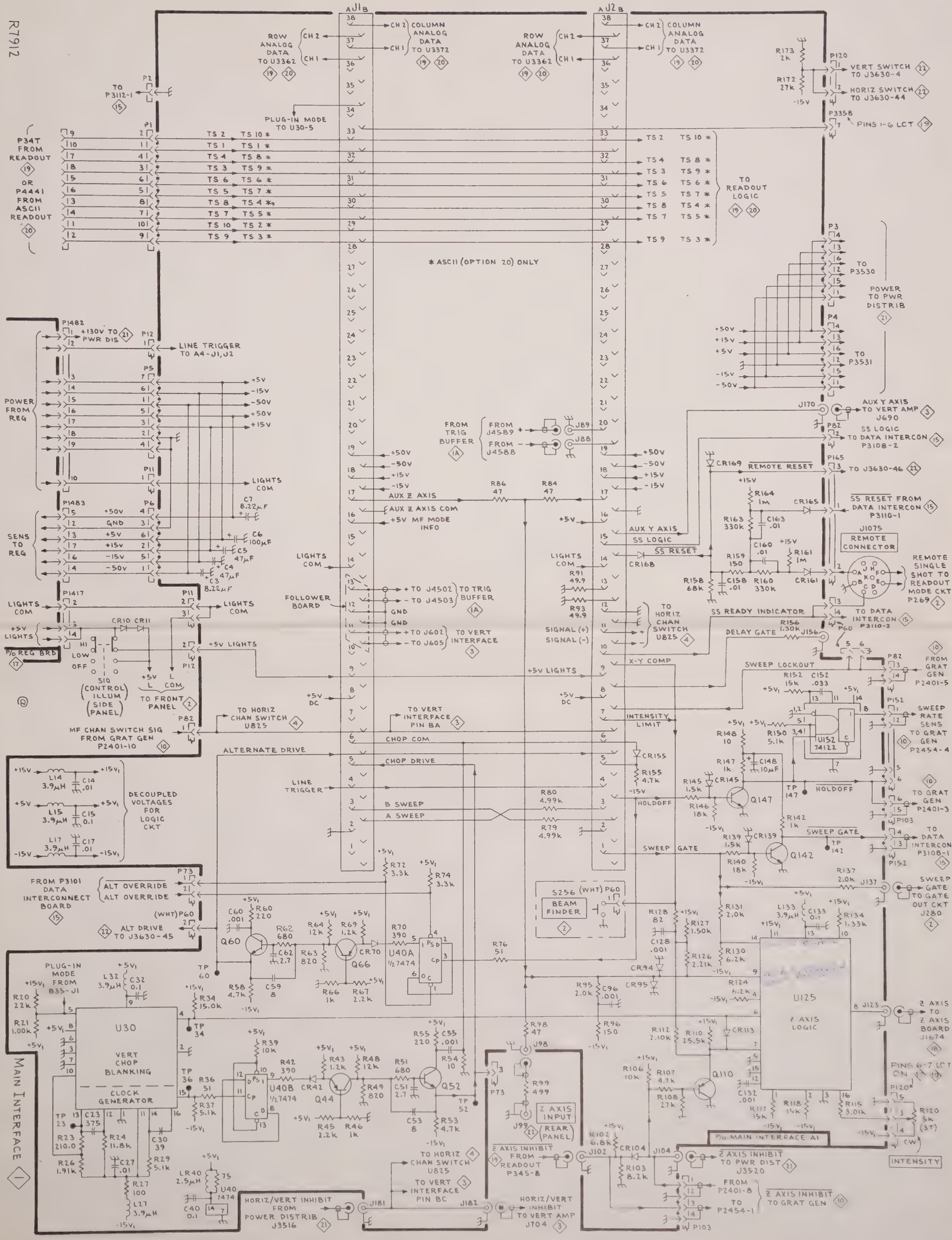
CKT NO	GRID LOC
J1	A5
J2	A2
J88	B1
J89	C3
J98	F4
J102	B9
J104	C9
J123	C9
J137	F3
J156	F3
J170	C1
J181	F1
J182	F4
J848	E2
J849	E2
J3366	C8
J3376	C8
L14	D6
L15	E6
L17	D6
L27	E8
L32	E7
L133	D7
LR40	E7
P1	A7
P2	A5
P3	B4
P4	B4
P5	B4
P6	B4
P11	D4
P12	E4
P60	F2
P73	F8
P82	F2
P103	B9
P120	D9
P152	B9
P165	B1
P260	A7
P825	E1
P827	D1
P3358	C8
P3360	C7
Q44	E7
Q52	F7
Q60	E6
Q66	E6
Q110	C7
Q142	C8
Q147	B8
Q3365	C7
Q3375	C7

CKT NO	GRID LOC
R20	D8
R21	D7
R23	E8
R24	E8
R26	E8
R27	E9
R29	E9
R34	D8
R36	E7
R37	E7
R39	E6
R42	E6
R43	E7
R45	E7
R46	E7
R48	E7
R49	E8
R51	F7
R53	E5
R54	F5
R55	F6
R58	E6
R60	E5
R62	E6
R63	D6
R64	D7
R66	D6
R67	E7
R70	E6
R72	F8
R74	F8
R76	E6
R79	E5
R80	E4
R84	D3
R86	D6
R91	D3
R93	D3
R95	D6
R96	D6
R98	E5
R102	C8
R103	C8
R106	C8
R107	C7
R108	C7
R110	C6
R112	D7
R113	E3
R115	D8
R117	D8
R118	D8
R124	C8
R127	C7
R128	C6
R130	D8
R126	D6

CKT NO	GRID LOC
R131	E3
R134	D7
R137	E3
R139	E3
R140	C8
R142	C8
R145	F8
R146	B8
R147	B8
R148	B8
R150	B8
R152	C8
R155	E3
R156	E3
R158	B2
R159	A2
R160	A1
R161	B1
R163	A2
R164	B1
R172	D8
R173	D8
R262	A8
R263	B7
R264	A8
R821	D2
R823	E2
R825	E1
R827	D1
R828	D2
R829	D1
R831	E1
R833	D1
R835	C2
R841	C2
R838	C2
R839	C1
R844	D2
R846	E2
R3355	C6
R3357	C6
R3359	C6
R3368	C8
R3369	C7
R3376	C7
R3378	A6
R3379	A6
R3381	B6
R3383	B6
R3384	B6
R3386	B6
R3387	B6
R3389	B6
R3390	A7
R3391	A7
R3393	
R3394	
R3396	

CKT NO	GRID LOC
R3397	B7
R3398	B7
R3399	B7
S259	E3
TP23	E9
TP34	E9
TP36	E9
TP52	F6
TP60	E6
TP142	A9
TP147	B8
TP828	D2
U30	E8
U40	E6
U125	D7
U152	B8
U825	D2
U3362	B7
U3372	B6

R7912


AJ1B
AJ2B
ROW ANALOG DATA TO U3362
COLUMN ANALOG DATA TO U3372
CH2
CH1
TO P3112-1
P2
P1
PLUG-IN MODE TO U30-5
P34T FROM READOUT
OR P4441 FROM ASCII READOUT
TS 2 TS 10 *
TS 1 TS 1 *
TS 4 TS 8 *
TS 3 TS 9 *
TS 6 TS 6 *
TS 5 TS 7 *
TS 8 TS 4 *
TS 7 TS 5 *
TS 10 TS 2 *
TS 9 TS 3 *
* ASCII (OPTION 20) ONLY
TO READOUT LOGIC
R173 2k
R172 27k
-15V
P120
VERT SWITCH TO U3630-4
HORIZ SWITCH TO U3630-44
P3358
PINS 1-6 LCT
P3
TO P3530
POWER TO PWR DISTRIB
P4
TO P3531
+50V
+15V
+5V
-15V
-50V
P1482
+130V TO PWR DIS
P12
LINE TRIGGER TO A4-J1,J2
P5
POWER FROM REG
P11
LIGHTS COM
P1483
SENS TO REG
P6
C7 8.22µF
C6 100µF
C5 47µF
C4 47µF
C3 8.22µF
P1417
LIGHTS COM
+5V LIGHTS
P/O REG BRD
CR10 CR11
HI
LOW
OFF
S10 (CONTROL ILLUM SIDE PANEL)
+5V L COM
TO FRONT PANEL
P82
MF CHAN SWITCH SIG FROM GRAT GEN P2401-10
TO HORIZ CHAN SWITCH U825
TO VERT INTERFACE PIN BA
ALTERNATE DRIVE
CHOP COM
CHOP DRIVE
LINE TRIGGER
B SWEEP
A SWEEP
+5V DC
DECOUPLED VOLTAGES FOR LOGIC CKT
L14 3.9µH C14 .01
L15 3.9µH C15 0.1
L17 3.9µH C17 .01
FROM P3101 DATA INTERCONNECT BOARD
P73
ALT OVERRIDE
(WHT) P60
ALT DRIVE TO U3630-45
FROM TRIG BUFFER
FROM J4589
FROM J4588
J89
J88
AUX Z AXIS
AUX Z AXIS COM
+5V MF MODE INFO
R86 47
R84 47
AUX Y AXIS
SS LOGIC
SS RESET
CR168
FOLLOWER BOARD
+ TO J4502
- TO J4503
TO TRIG BUFFER
GND
+ TO J602
- TO J605
TO VERT INTERFACE
R91 49.9
R93 49.9
SIGNAL (+)
SIGNAL (-)
TO HORIZ CHAN SWITCH U825
X-Y COMP
INTENSITY LIMIT
CR155
R155 4.7k
HOLDOFF
SWEEP GATE
S256 (WHT) P60
BEAM FINDER
J170
AUX Y AXIS TO VERT AMP J690
P82
SS LOGIC TO DATA INTERCON P3108-2
P165
TO J3630-46
CR169
REMOTE RESET
SS RESET FROM DATA INTERCON P3110-1
R164 1M
CR165
R163 330k
C163 .01
C160 .01
J1075 REMOTE CONNECTOR
R159 150
R161 1M
R158 68k
C158 .01
R160 330k
CR161
REMOTE SINGLE SHOT TO READOUT MODE CKT P269
SS READY INDICATOR
TO DATA INTERCON P3110-2
R156 1.30k
DELAY GATE
J156
P60
SWEEP LOCKOUT
FROM GRAT GEN P2401-5
R152 15k
C152 .033
P152
SWEEP RATE SENS TO GRAT GEN P2454-4
U152 74122
R150 3.4k
R148 10
R147 1k
C148 10µF
R145 1.5k
CR145
Q147
R146 18k
TP 147
TO GRAT GEN P2401-3
P103
R142 1k
SWEEP GATE
TO DATA INTERCON P3108-1
R139 1.5k
CR139
Q142
R140 18k
TP 142
R137 2.0k
J137
SWEEP GATE TO GATE OUT CKT J280
R128 82
R131 2.0k
L133 3.9µH
C133 0.1
R134 1.33k
R127 1.50k
C128 .001
R126 2.21k
R130 6.2k
CR94
CR95
R95 2.0k
C96 .001
R124 6.2k
U125
Z AXIS LOGIC
J123
Z AXIS TO Z AXIS BOARD J1674
CURRENT DRIVE
R98 47
J98
R96 150
R99 499
Z AXIS INPUT
J99
(REAR PANEL)
R112 2.10k
R110 25.5k
CR113
R106 10k
R107 4.7k
Q110
R108 27k
C132 .001
R117 15k
R118 15k
R115 3.01k
R120 5k (3T)
INTENSITY
P/O MAIN INTERFACE A1
R102 6.8k
CR104
J102
J104
Z AXIS INHIBIT FROM READOUT P345-8
Z AXIS INHIBIT TO PWR DIST J3520
FROM P2401-8 TO P2454-1
Z AXIS INHIBIT TO GRAT GEN
R103 8.2k
U30
VERT CHOP BLANKING
CLOCK GENERATOR
PLUG-IN MODE FROM B35-J1
L32 3.9µH C32 0.1
R20 22k
R21 1.00k
TP 60
TP 34
TP 36
TP 23
TP 52
R34 15.0k
R58 4.7k
C59 8
C60 .001
R60 220
Q60
R62 680
C62 2.7
R63 820
R64 12k
R69 1.2k
CR70
Q66
R66 1k
R67 2.2k
R70 390
U40A 1/2 7474
R72 3.3k
R74 3.3k
R76 51
R36 51
R37 5.1k
R39 10k
R42 390
U40B 1/2 7474
CR42
Q44
R43 1.2k
R48 12k
R49 820
R45 2.2k
R46 1k
R51 680
C51 2.7
C53 8
R55 220
C55 .001
R54 10
Q52
R53 4.7k
C23 375
R23 210.0
R24 11.8k
C30 39
R26 1.91k
C27 .01
R29 5.1k
R27 100
L27 3.9µH
LR40 2.5µH
75
U40 7474
C40 0.1
HORIZ/VERT INHIBIT FROM POWER DISTRIB J3516
J181
J182
HORIZ/VERT INHIBIT TO VERT AMP J704
TO VERT INTERFACE PIN BC
TO HORIZ CHAN SWITCH U825
MAIN INTERFACE

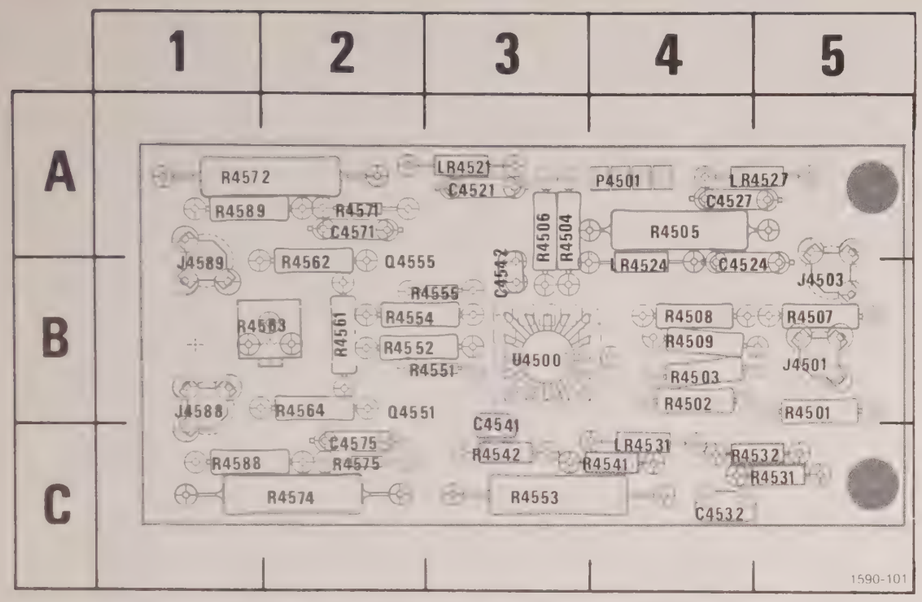
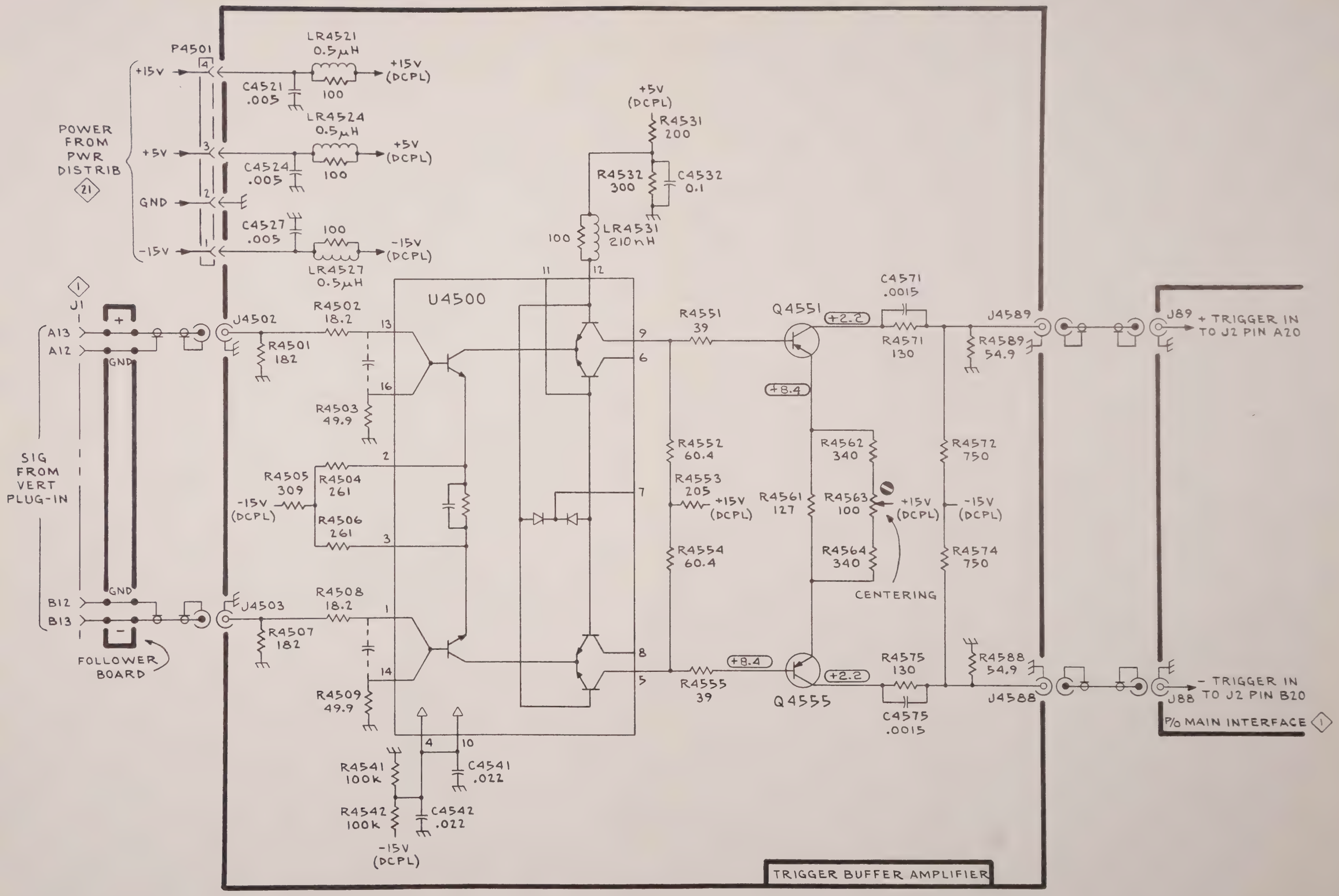


Fig. 8-1A. A37—Trigger Buffer circuit board (SN B090000 & UP).

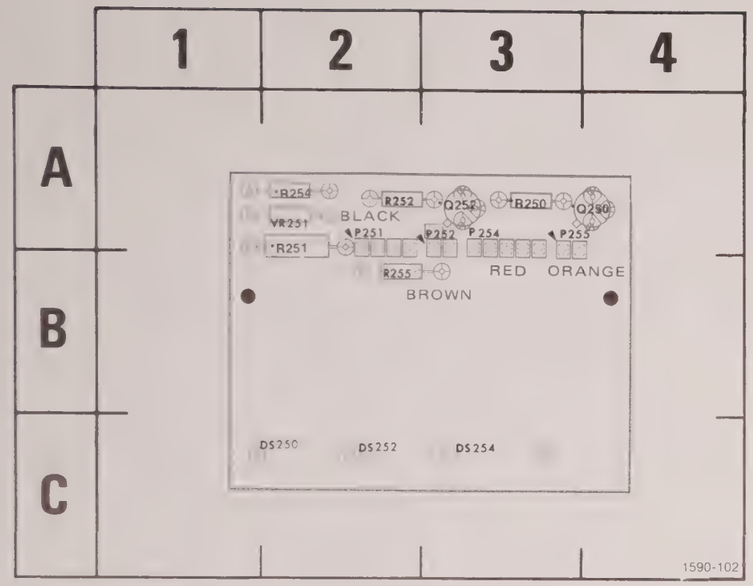
CKT NO	GRID LOC	CKT NO	GRID LOC
C4521	A3	R4501	B5
C4524	A4	R4502	B4
C4527	A4	R4503	B4
C4532	C4	R4504	A3
C4541	B3	R4505	A4
C4542	B2	R4506	A3
C4571	A2	R4507	B5
C4575	C2	R4508	B4
		R4509	B4
J4501	B5	R4531	C5
J4503	B5	R4532	C4
J4588	B1	R4541	C4
J4589	B1	R4542	C3
		R4555	B3
LR4521	A3	R4561	B2
LR4524	B4	R4562	B2
LR4527	A5	R4563	B2
LR4531	C4	R4564	B2
		R4571	A2
P4501	A4	R4572	A2
		R4574	C2
Q4555	B3	R4575	C2
Q4551	B2	R4588	C1
		R4589	A1
		U4500	B3



R7912

@

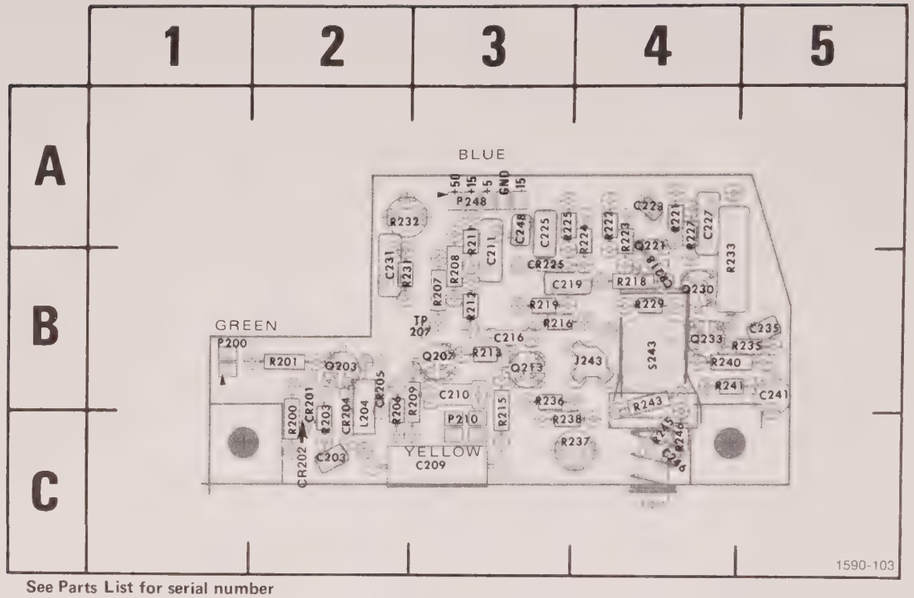
TRIGGER BUFFER AMPLIFIER 1A
SN B090000-UP



*See Parts List for serial number ranges.

Fig. 8-2. A4—Mode Switch circuit board.

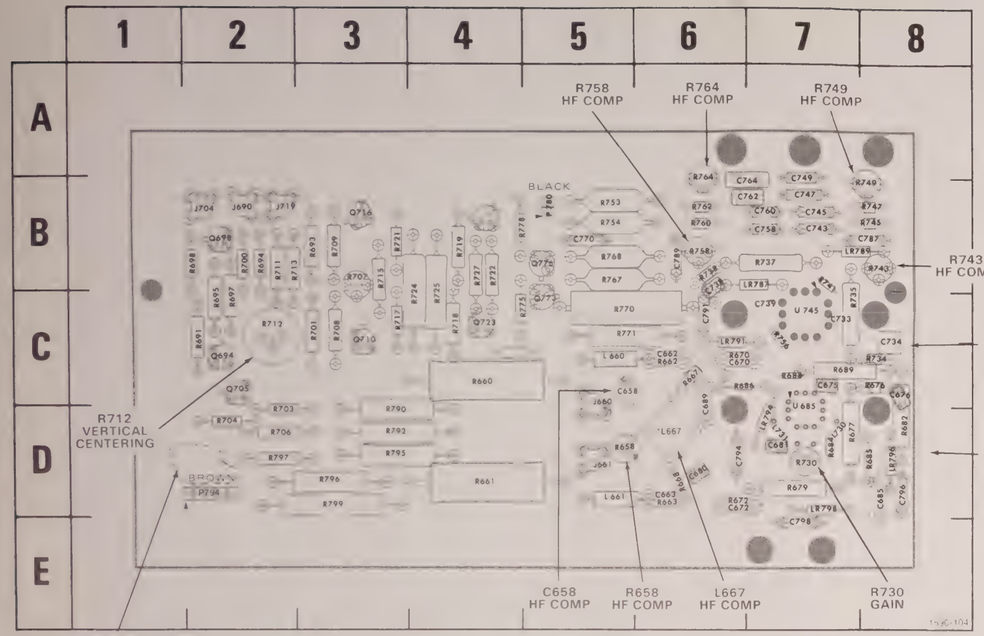
CKT NO	GRID LOC
DS250	C2
DS252	C2
DS254	C3
P251	A2
P252	A3
P254	A3
P255	A3
Q250	A4
Q252	A3
R250	A3
R251	A2
R252	A2
R254	A2
R255	B2
VR251	A2



See Parts List for serial number ranges of all components.

Fig. 8-3. A3—Calibrator circuit board.

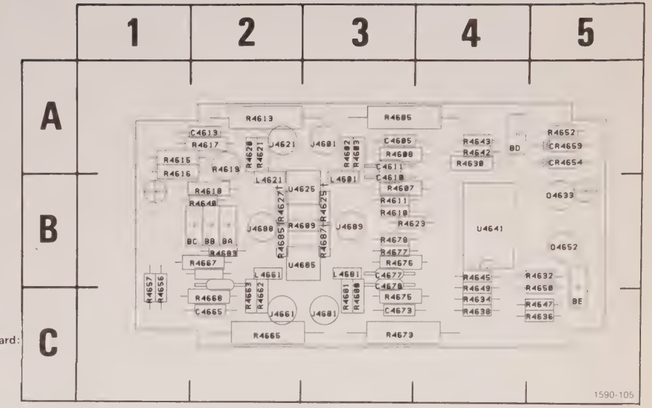
CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C203	C2	J243	B4	R208	B3	R236	B3
C209	C3			R209	B3	R237	C4
C210	B3	L204	C2	R211	A3	R238	C3
C211	A3			R212	B3	R240	B4
C216	B3	P200	B1	R213	B3	R241	B4
C219	B3	P210	C3	R215	B3	R243	B4
C223	A4	P248	A3	R216	B3	R245	C4
C225	A3			R218	B4	R246	C4
C227	A4	Q203	B2	R219	B3		
C231	B2	Q207	B3	R221	A4	S243	B4
C235	B5	Q213	B3	R222	A4		
C241	B5	Q221	A4	R223	A4	TP207	B3
C246	C4	Q230	B4	R224	A4		
C248	A3	Q233	B4	R225	A3		
				R227	A4		
CR201	B2	R200	C2	R229	B4		
CR202	C2	R201	B2	R231	B2		
CR204	C2	R203	C2	R232	A2		
CR205	B2	R206	B2	R233	B4		
CR218	B4	R207	B3	R235	B5		
CR225	B3						



On back of board:
*CR787 *R784
*Q785 *R785
*Q786 *R786
*R783 *R788

*See Parts List for serial number ranges.

Fig. 8-4. A5 Vertical Amplifier circuit board.



†On back of board

Fig. 8-4A. A8—Vertical Interface circuit board (SN B140000 & UP).

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C4605	3A	J4601	3A	Q4633	5B	R4613	2A	R4630	4A	R4650	5B	R4676	3B	U4625	2B
C4610	3B	J4621	2A	Q4652	5B	R4615	1A	R4632	5B	R4652	5A	R4677	3B	U4641	4B
C4611	3A	J4661	2C			R4616	1B	R4634	4C	R4656	1B	R4678	3B	U4685	2B
C4613	2A	J4681	3C	R4602	3A	R4617	2A	R4636	5C	R4657	1B	R4680	3C		
C4665	2C	J4688	2B	R4603	3A	R4618	2B	R4638	4C	R4662	2C	R4681	3C		
C4673	3C	J4689	3B	R4505	3A	R4619	2A	R4640	2B	R4663	2C	R4683	2B		
C4677	3B			R4607	3B	R4620	2A	R4642	4A	R4665	2C	R4685	3B		
C4678	3B	L4601	3B	R4608	3A	R4621	2A	R4643	4A	R4667	2A	R4687	3B		
		L4621	2B	R4610	3B	R4623	3B	R4645	4B	R4668	2C	R4689	2B		
CR4653	5A	L4661	2B	R4611	3B	R4625	2B	R4647	5C	R4673	3C				
CR4654	5A	L4681	3C			R4627	2B	R4649	4C	R4675	3C				

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C658	C5	C738	B6	C791	C6	L667	D6	Q694	C2	R663	D6	R689	C7	R708	C3	R727	B4	R756	C6	R795	D3
C662	C6	C739	C7	C794	D6	L730	D7	Q698	B2	R667	C6	R691	C2	R709	B3	R730	D7	R758	B6	R796	D3
C663	D6	C743	B7	C796	D8	L731	D7	Q705	C2	R668	D6	R693	B3	R711	B2	R734	C8	R760	B6	R797	D2
C670	C6	C745	B7	C798	E7	LR789	B8	Q710	C3	R670	C6	R694	B2	R712	C2	R735	C7	R762	B6	R799	D3
C672	D6	C747	B7			LR791	C6	Q716	B3	R672	D6	R695	C2	R713	B2	R737	B7	R764	A6		
C675	C7	C749	A7	J660	C5	LR794	D7	Q723	C4	R676	C8	R697	C2	R715	B3	R738	B6	R768	B5	U685	C7
C676	C8	C758	B7	J661	D5	LR796	D8	Q773	C5	R677	D7	R698	B2	R717	C3	R741	B7	R770	C5	U745	C7
C680	D6	C760	B7	J690	B2	LR798	D7	Q776	B5	R679	D7	R700	B2	R718	C4	R743	B8	R771	C5		
C681	D7	C762	B7	J704	B2					R682	D8	R701	C3	R719	B4	R745	B8	R775	C4		
C685	D8	C764	A7	J719	B2	P700	D2	R658	D5	R684	D7	R703	D2	R721	B3	R747	B8	R778	B4		
C689	C6	C770	B5			P780	B5	R660	C4	R685	D8	R704	D2	R722	B4	R749	A8	R787	B7		
C733	C7	C787	B8	L660	C5			R661	D4	R686	C6	R706	D2	R724	C4	R753	B5	R790	D3		
C734	C8	C789	B6	L661	D5			R662	C6	R688	C7	R707	B3	R725	C4	R754	B5	R792	D3		

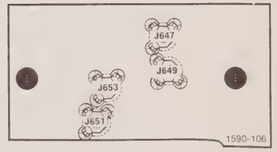
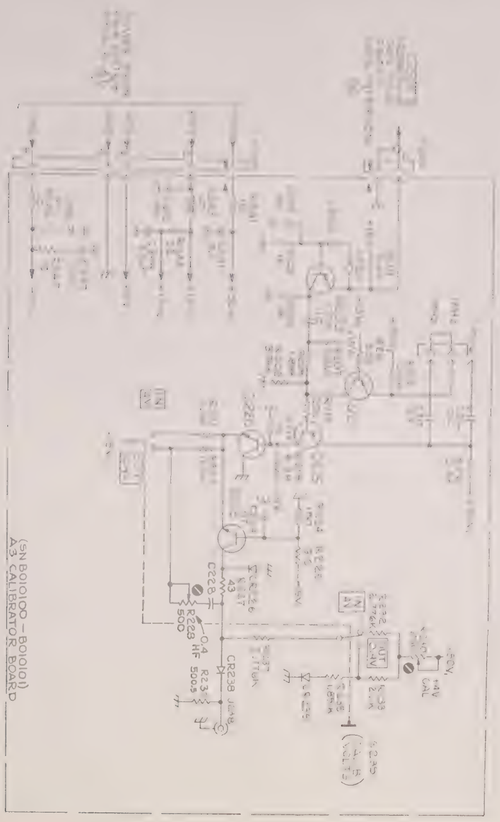
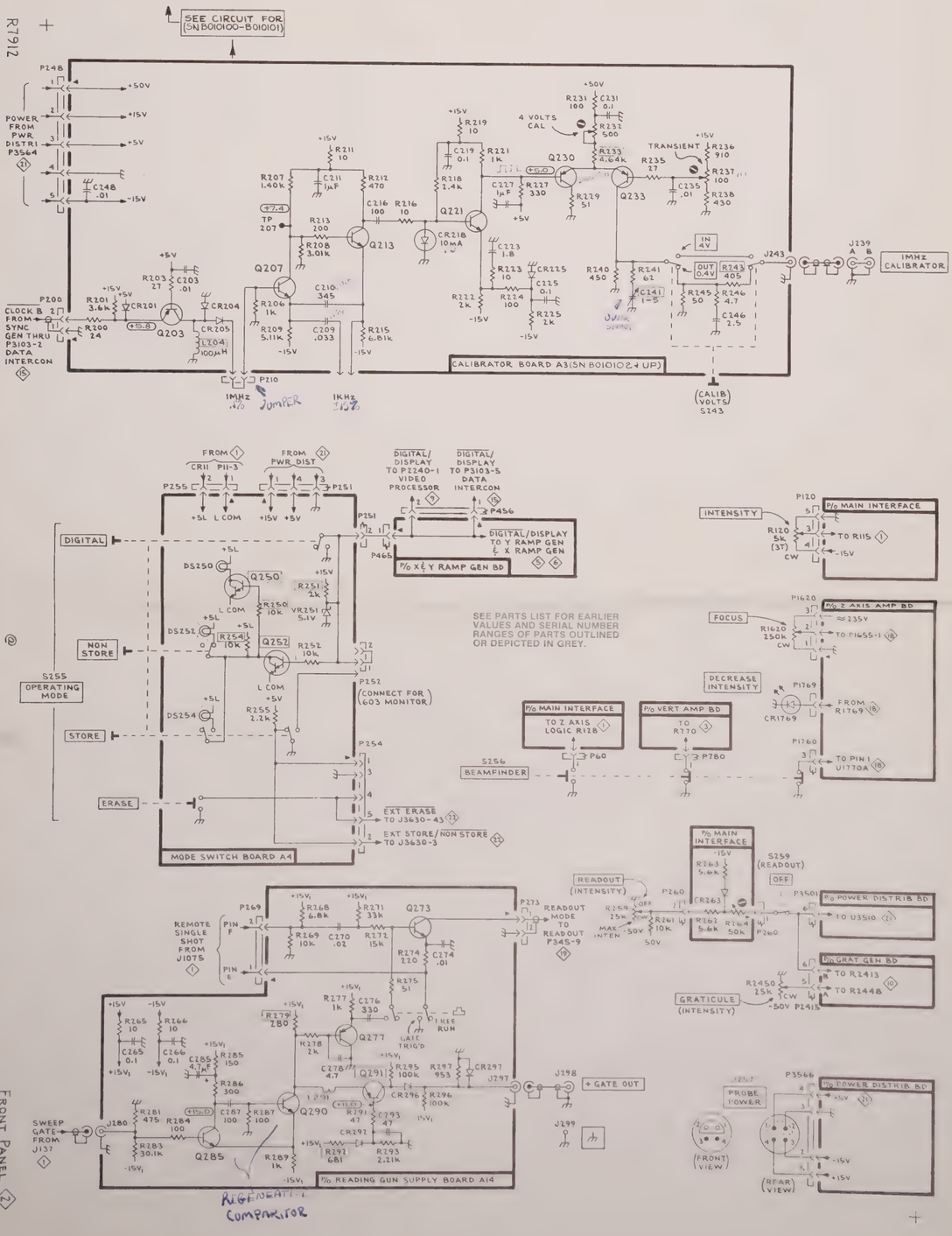
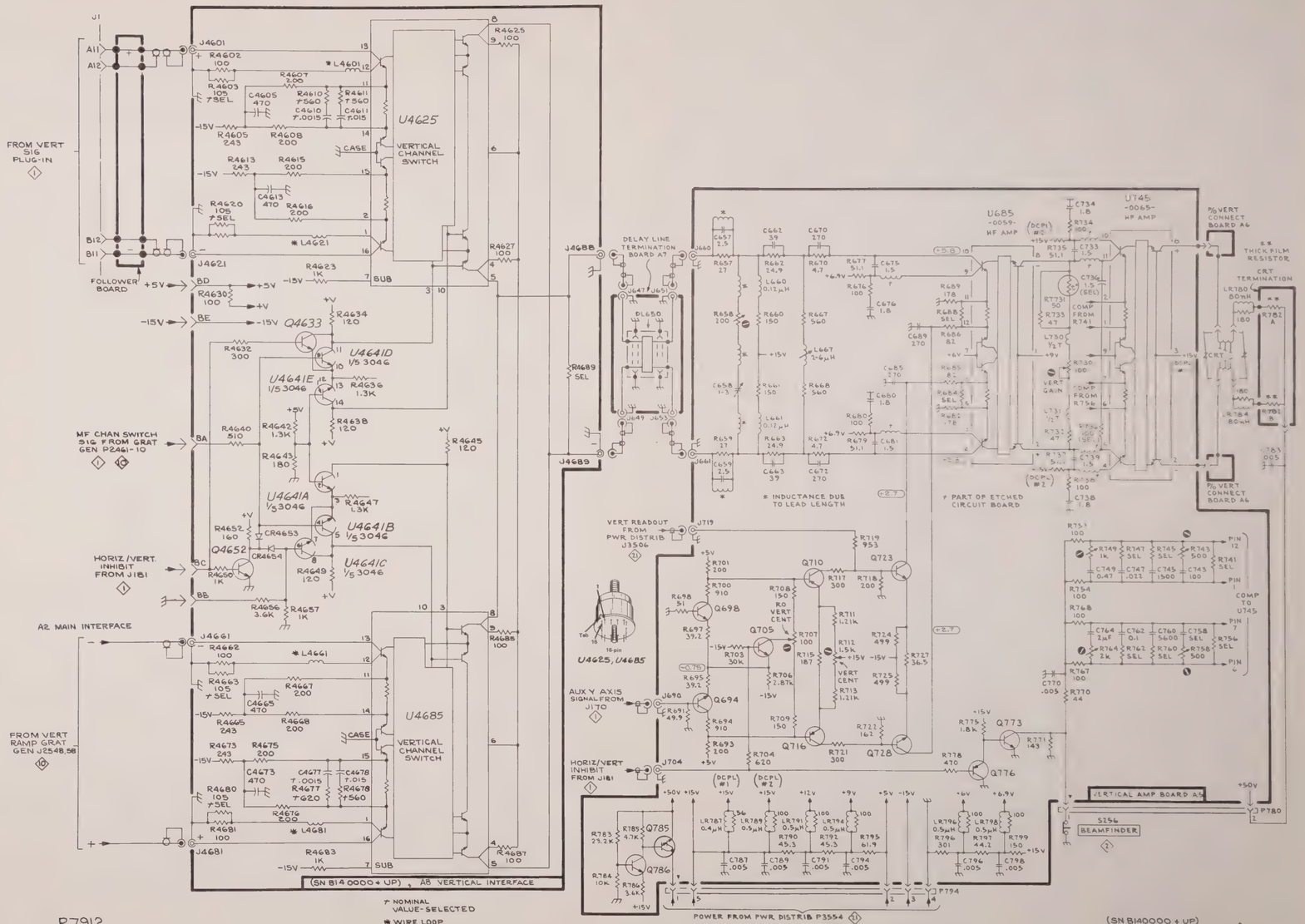


Fig. 8-5. A7—Delay Line Termination circuit board.

Fig. 8-5A. A6—Vertical Connect circuit board.


(SN B010100-B010101)
A3 CALIBRATOR BOARD


R7912
SEE CIRCUIT FOR (SN B010100-B010101)
POWER FROM PWR DISTR1 P3564
CLOCK B FROM SYNC GEN THRU P3103-2 DATA INTERCON
CALIBRATOR BOARD A3 (SN B010102 & UP)
4 VOLTS CAL
TRANSIENT
IN 4V
OUT 0.4V
IMHZ CALIBRATOR
(CALIB VOLTS) S243
1MHZ
JUMPER
1KHZ
FROM PWR DIST
DIGITAL/DISPLAY TO P2240-1 VIDEO PROCESSOR
DIGITAL/DISPLAY TO P3103-5 DATA INTERCON
DIGITAL/DISPLAY TO Y RAMP GEN & X RAMP GEN
P/O X & Y RAMP GEN BD
DIGITAL
NON STORE
STORE
ERASE
S255 OPERATING MODE
(CONNECT FOR 603 MONITOR)
EXT ERASE TO J3630-43
EXT STORE/NON STORE TO J3630-3
MODE SWITCH BOARD A4
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
INTENSITY
P/O MAIN INTERFACE
FOCUS
P/O Z AXIS AMP BD
DECREASE INTENSITY
P/O MAIN INTERFACE TO Z AXIS LOGIC R128
P/O VERT AMP BD
S256 BEAMFINDER
TO PIN 1 U1770A
P/O MAIN INTERFACE
S259 (READOUT)
READOUT (INTENSITY)
P/O POWER DISTRIB BD
P/O GRAT GEN BD
GRATICULE (INTENSITY)
REMOTE SINGLE SHOT FROM J1075
READOUT MODE TO READOUT P345-9
+ GATE OUT
SWEEP GATE FROM J137
P/O READING GUN SUPPLY BOARD A14
REGENERATIVE COMPARITOR
PROBE POWER
(FRONT VIEW)
(REAR VIEW)
P/O POWER DISTRIB BD
FRONT PANEL 2


FROM VERT 516 PLUG-IN
FOLLOWER BOARD
MF CHAN SWITCH SIG FROM GRAT GEN P2461-10
HORIZ/VERT. INHIBIT FROM J181
A2 MAIN INTERFACE
FROM VERT RAMP GRAT GEN J2548,58
U4625 VERTICAL CHANNEL SWITCH
U4685 VERTICAL CHANNEL SWITCH
Q4633
U4641D 1/5 3046
U4641E 1/5 3046
U4641A 1/5 3046
U4641B 1/5 3046
U4641C 1/5 3046
Q4652
CR4653
CR4654
(SN B140000 + UP), A8 VERTICAL INTERFACE
* NOMINAL VALUE-SELECTED
* WIRE LOOP
DELAY LINE TERMINATION BOARD A7
DL650
U685 -0059- HF AMP
U745 -0065- HF AMP
* INDUCTANCE DUE TO LEAD LENGTH
+ PART OF ETCHED CIRCUIT BOARD
P/O VERT CONNECT BOARD A6
** THICK FILM RESISTOR
CRT TERMINATION
VERT READOUT FROM PWR DISTRIB J3506
AUX Y AXIS SIGNAL FROM J170
HORIZ/VERT INHIBIT FROM J181
U685, U745
16-pin
VERT CENT
VERT GAIN
COMP FROM R741
COMP FROM R756
COMP TO U745
VERTICAL AMP BOARD A5
5256 BEAMFINDER
POWER FROM PWR DISTRIB P3554
R7912
(SN B140000 + UP) VERTICAL AMPLIFIER 3
VERTICAL AMPLIFIER (SN B140000 & UP) 3

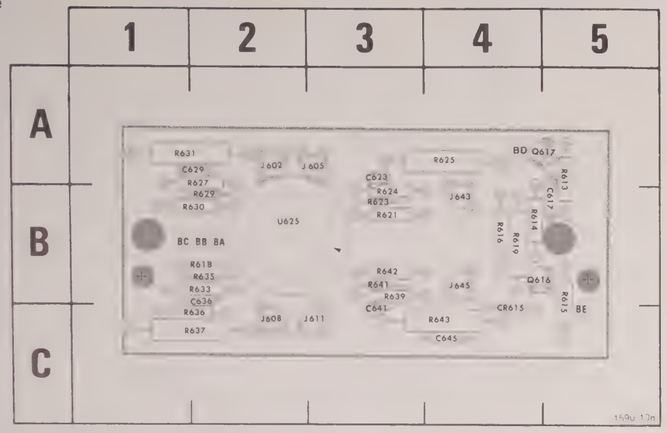
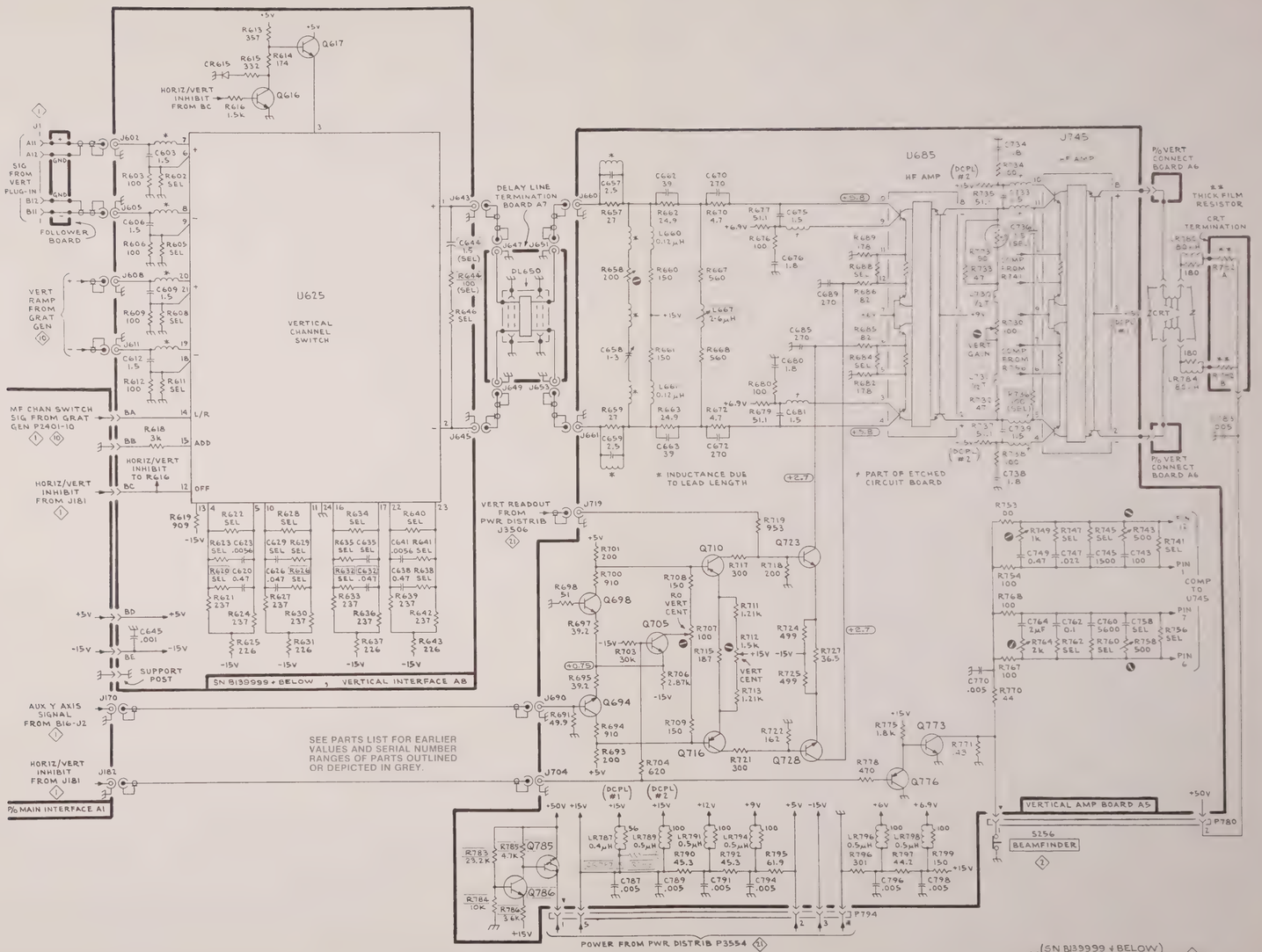


Fig. 8-6. A8—Vertical Interface circuit board.(SN B139999-BELOW)

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C617	B5	J602	A2	Q617	A4	R618	B2	R631	A1	R643	C4
C623	A3	J605	A3	Q616	B4	R621	B3	R633	B2		
C629	A2	J608	C3			R623	B3	R635	B2	U625	B2
C636	B2	J611	C3	R613	A5	R624	B3	R636	C2		
C641	C3	J643	B4	R614	B4	R625	A4	R637	C2		
C645	C4	J645	B4	R615	B5	R627	A2	R639	B3		
				R616	B4	R629	B2	R641	B3		
CR615	C4			R619	B4	R630	B2	R642	B3		


U625
VERTICAL CHANNEL SWITCH
DELAY LINE TERMINATION BOARD A7
U685
HF AMP
J745
P/O VERT CONNECT BOARD A6
THICK FILM RESISTOR
CRT TERMINATION
FOLLOWER BOARD
SIG FROM VERT PLUG-IN
VERT RAMP FROM GRAT GEN
MF CHAN SWITCH SIG FROM GRAT GEN P2401-10
HORIZ/VERT INHIBIT FROM J181
HORIZ/VERT INHIBIT FROM BC
HORIZ/VERT INHIBIT TO R616
SUPPORT POST
AUX Y AXIS SIGNAL FROM B16-J2
P/O MAIN INTERFACE A1
VERT READOUT FROM PWR DISTRIB U3506
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
SN B139999 & BELOW , VERTICAL INTERFACE AB
* INDUCTANCE DUE TO LEAD LENGTH
† PART OF ETCHED CIRCUIT BOARD
VERTICAL AMP BOARD A5
5256 BEAMFINDER
POWER FROM PWR DISTRIB P3554
(SN B139999 & BELOW) VERTICAL AMPLIFIER
R7912

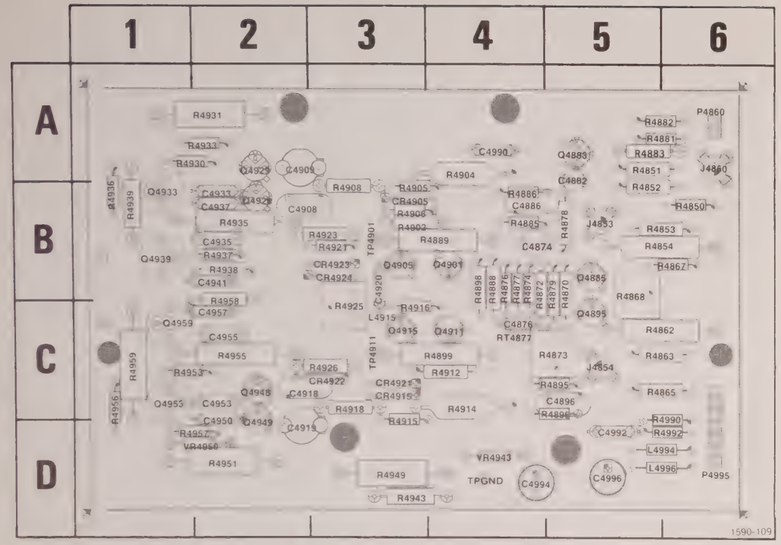
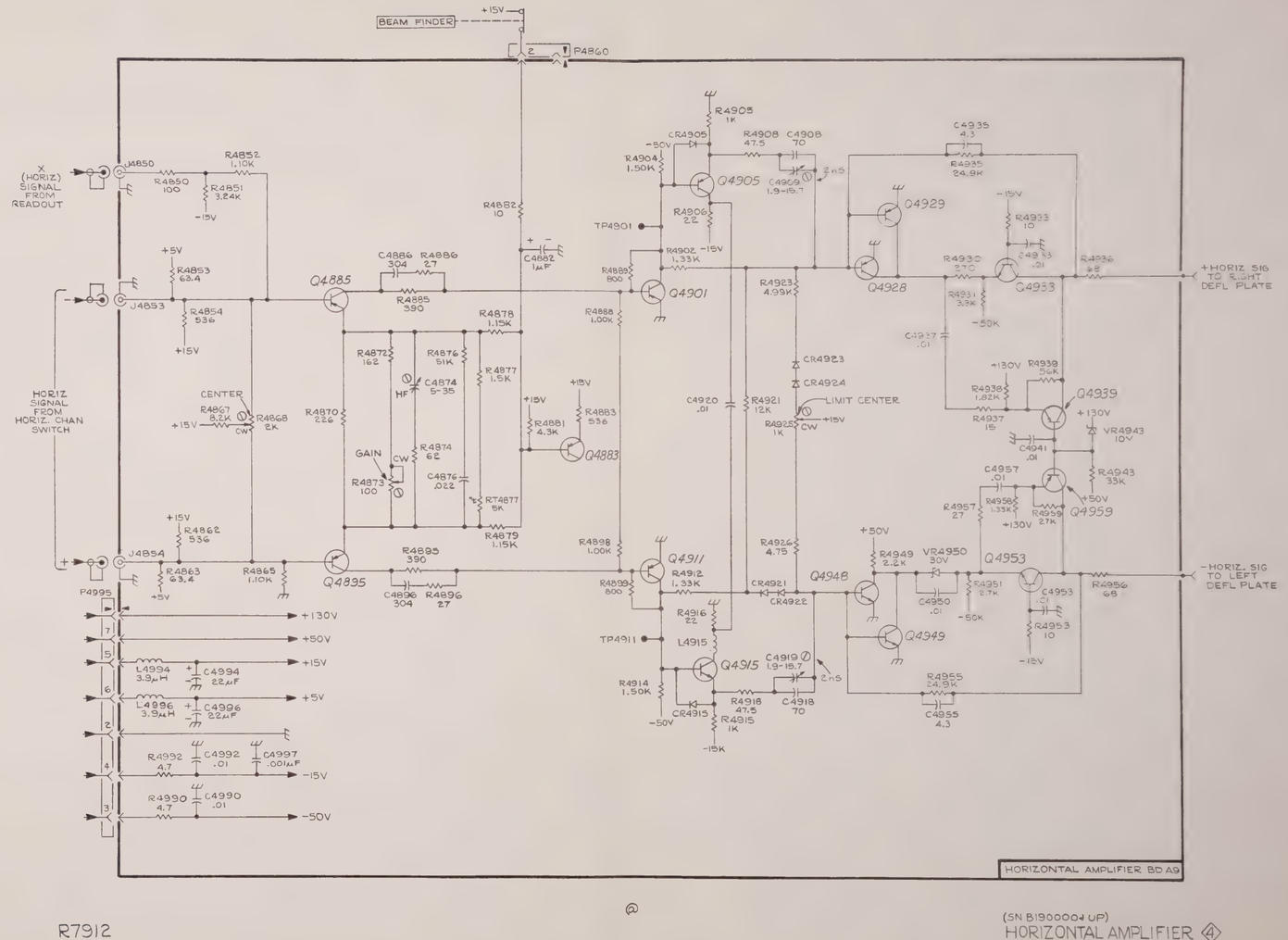


Fig. 8-7. A9—Horizontal Amplifier circuit board (SN B190000 & UP).

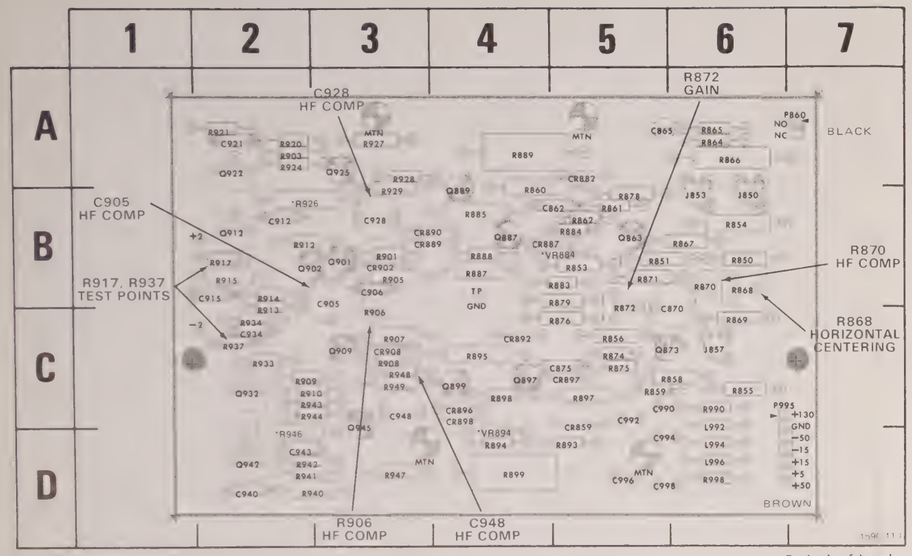
CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C4874	A4	C4957	C2	P4860	A6	R4850	B6	R4883	A5	R4921	B3	R4958	C2
C4876	C4	C4990	A4	P4995	D6	R4851	A5	R4885	B4	R4923	B3	R4959	C1
C4882	A5	C4992	D5			R4852	B5	R4886	B4	R4925	C3	R4990	D2
C4886	B4	C4994	D4	Q4883	B5	R4853	B5	R4888	B4	R4926	C3	R4992	D6
C4869	C5	C4996	D5	Q4885	B5	R4854	B5	R4889	B4	R4930	A1		
C4905	B3			Q4895	C5	R4862	C5	R4895	C5	R4931	A2	RT4877	C4
C4908	B2	CR4905	B3	Q4901	B4	R4863	C5	R4898	B4	R4933	A2		
C4909	A2	CR4915	C3	Q4905	B2	R4865	C5	R4896	C5	R4935	B2	TP GND	D4
C4918	C2	CR4921	C3	Q4911	C4	R4867	B6	R4899	C4	R4936	B1	TP4901	B3
C4919	D1	CR4922	C3	Q4915	C3	R4868	B5	R4902	B3	R4937	B2	TP4911	C3
C4920	A4	CR4923	B3	Q4928	B2	R4870	B5	R4904	B3	R4938	B2		
C4923	B2	CR4924	B3	Q4929	A2	R4872	B4	R4905	B3	R4939	B1	VR4950	D2
C4933	B2	L4915	C3	Q4933	B1	R4873	C4	R4906	B3	R4943	D3	VR4953	D4
C4935	B2	L4994	D6	Q4939	B1	R4874	B4	R4908	B3	R4949	D3		
C4937	B2	L4996	D6	Q4948	C2	R4877	B4	R4912	C4	R4951	D2		
C4941	B2			Q4949	C5	R4878	B5	R4914	C4	R4953	C1		
C4950	D1	J4850	A6	Q4953	C1	R4879	B5	R4915	D3	R4955	C2		
C4953	C2	J4853	B5	Q4959	C1	R4881	A5	R4916	C3	R4956	C1		
C4955	C2	J4854	C5			R4882	A5	R4918	C3	R4957	D2		



R7912

(SN B190000J UP)

HORIZONTAL AMPLIFIER ④

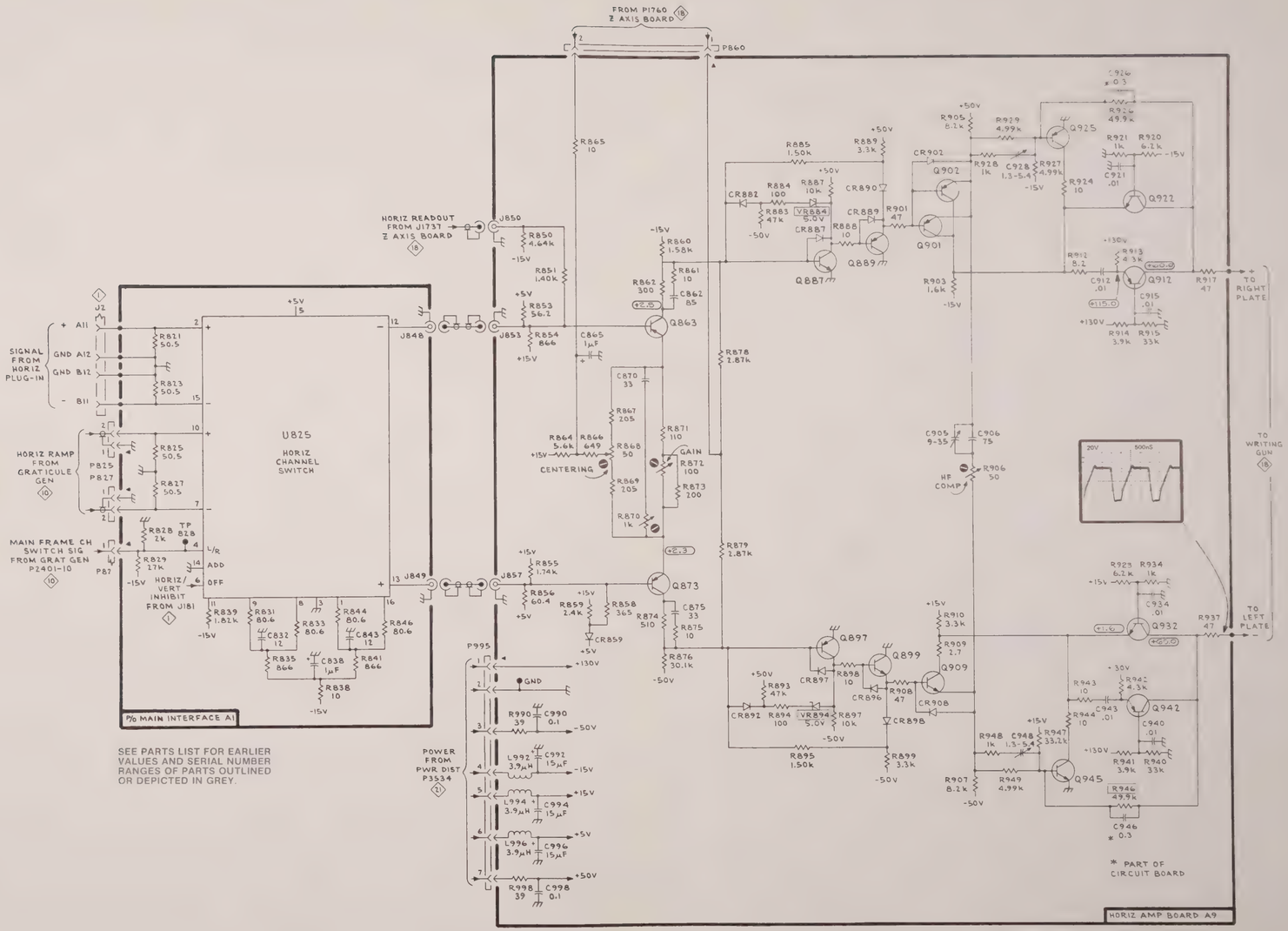


*See Parts List for serial number ranges.

On back of board: R873

Fig. 8-7A. A9—Horizontal Amplifier circuit board (SN B189999 & BELOW).

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C862	B5	CR859	D5	P860	A7	R850	B6	R874	C5	R906	C3	R937	C2
C865	A5	CR882	A5	P995	C6	R851	B5	R875	C5	R907	C3	R940	D2
C870	C6	CR887	B5			R853	B5	R876	C5	R908	C3	R941	D2
C875	C5	CR889	B3	Q863	B5	R854	B6	R878	B5	R909	C2	R942	D2
C905	B3	CR890	B3	Q873	C5	R855	C6	R879	B5	R910	C2	R943	C2
C906	B3	CR892	C4	Q887	B4	R858	C6	R885	B5	R912	B2	R944	C2
C912	B2	CR896	C4	Q889	B4	R859	C5	R884	B5	R913	C2	R946	D2
C915	B2	CR897	C5	Q987	C4	R860	B5	R887	B4	R914	B2	R947	D3
C921	A2	CR898	C4	Q899	C4	R861	B5	R888	B4	R915	B2	R948	C3
C928	B3	CR902	B3	Q901	B3	R862	B5	R889	A4	R917	B2	R949	C3
C934	C2	CR908	C3	Q902	B2	R865	A6	R893	D5	R920	A2	R990	C6
C940	D2			Q909	C3	R864	A6	R894	D4	R921	A2	R998	D6
C943	D2	J850	B6	Q912	B2	R866	A6	R895	C4	R924	A2		
C948	C3	J853	B6	Q922	A2	R867	B6	R897	C5	R926	B2	VR884	B5
C990	C5	J857	C6	Q925	A3	R868	B6	R898	C4	R928	A3	VR894	D4
C992	C5			Q932	C2	R869	C6	R899	D4	R927	A3		
C994	D5	L992	D6	Q942	D2	R870	B6	R901	B3	R929	B3		
C996	D5	L994	D6	Q945	D3	R871	B5	R903	A2	R933	C2		
C998	D5	L996	D6			R872	C5	R905	B3	R934	C2		



SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.

R7912

(SN B189999 & BELOW)
HORIZONTAL AMPLIFIER 4

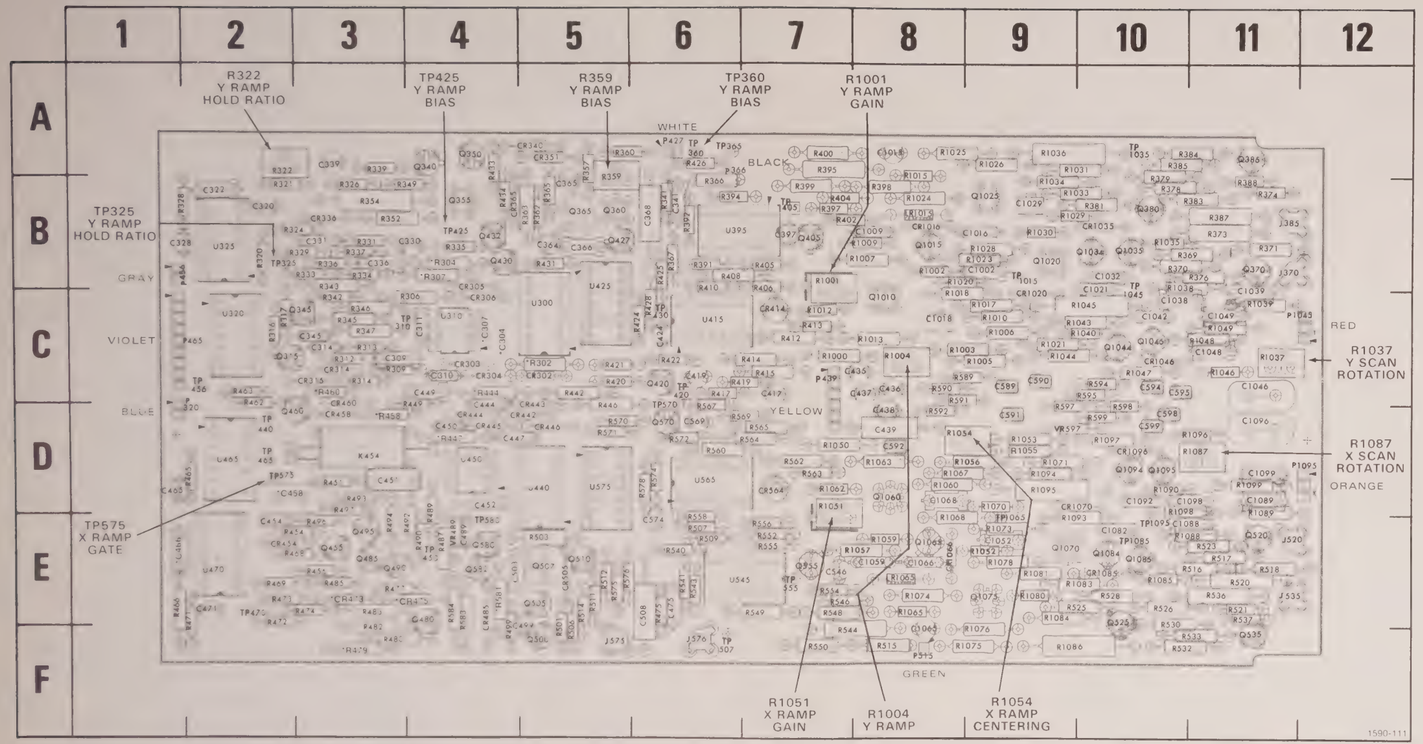
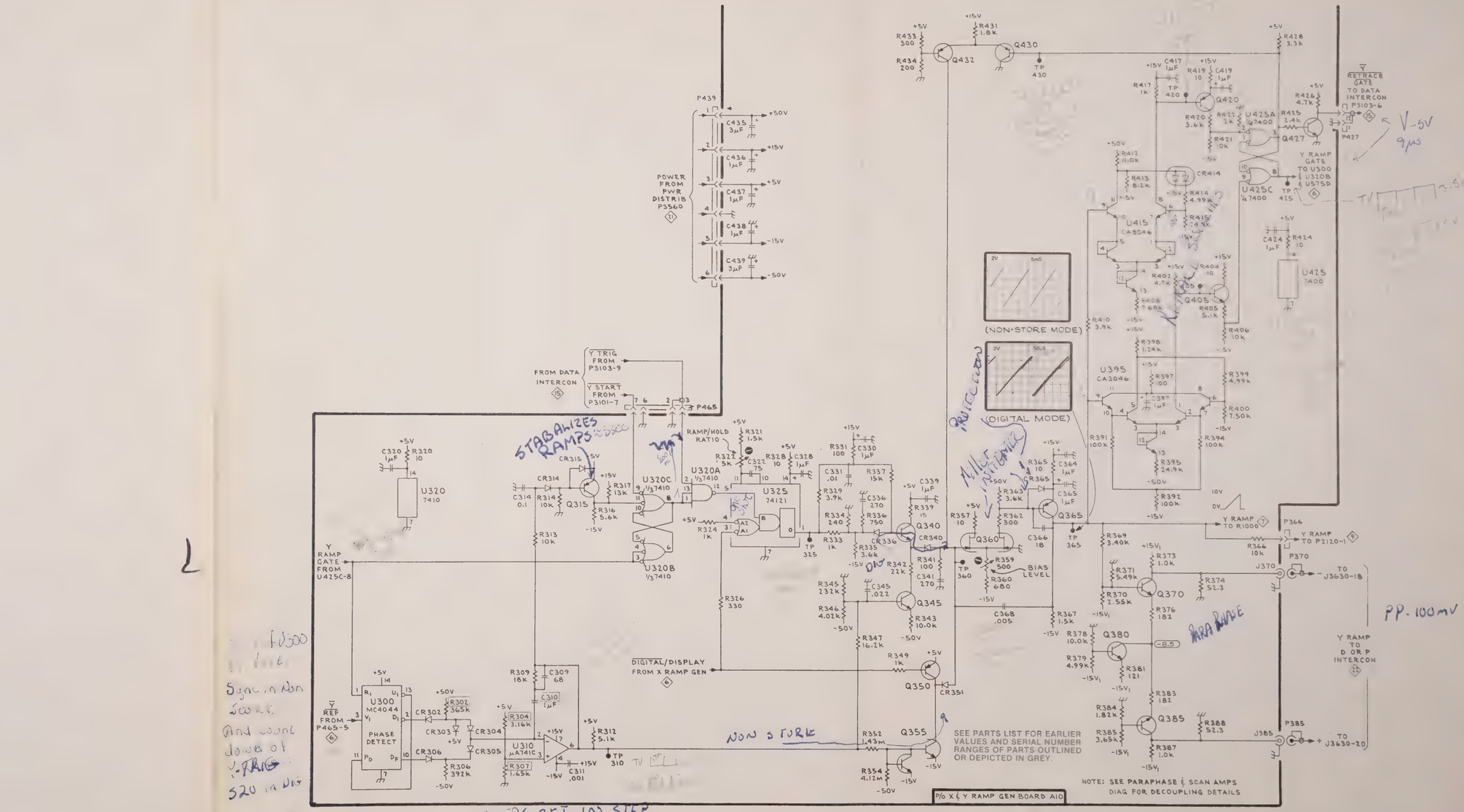


Fig. 8-8. A10 X and Y Ramp Generators circuit board.

*See Parts List for serial number ranges.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C304	C4																						
C307	C4	C339	A3	C419	C6	C451	D3	C503	E4	C595	C10	C1032	B10	C1068	D8	CR302	C5	CR365	B4	CR460	C3	CR1066	E8
C309	C3	C341	B6	C424	C6	C452	D4	C508	F6	C598	D10	C1038	C10	C1065	F8	CR303	C4	CR414	C7	CR475	E4	CR1070	D9
C310	C4	C345	C3	C435	C8	C454	E2	C546	E7	C599	D10	C1039	B11	C1082	E10	CR304	C4	CR442	D5	CR485	F4	CR1085	E10
C311	C4	C348	D8	C436	C8	C458	D2	C569	D6	C1002	B9	C1042	C10	C1088	E10	CR305	B4	CR443	C5	CR505	E5	CR1096	D10
C314	C3	C364	B5	C437	C8	C465	D1	C574	E6	C1009	B8	C1046	C11	C1089	D11	CR306	C4	CR444	D4	CR564	D7		
C320	B2	C365	B5	C439	D8	C466	E1	C589	C9	C1015	A8	C1048	C11	C1092	D10	CR314	C3	CR445	D4	CR1016	B8		
C322	B2	C366	B5	C444	C4	C471	E2	C590	C9	C1016	B9	C1049	C11	C1096	D11	CR315	C3	CR446	D5	CR1020	C9		
C328	B1	C368	B6	C447	D4	C475	E6	C591	D9	C1018	C8	C1052	E9	C1098	D11	CR336	B3	CR454	E2	CR1035	B10		
C330	B4	C397	B7	C449	C4	C489	E4	C592	D8	C1021	B10	C1059	E8	C1099	D11	CR340	A5	CR473	E3	CR1044	C10		
C331	B3	C417	C7	C450	D4	C499	F5	C594	C10	C1029	B9	C1066	E8			CR351	A5	CR458	D3	CR1046	C10		
C336	B3																						

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
J370	B11	Q1065	E8	R388	A11	R489	E4	R589	C8	R1063	D8	U300	C5
J385	B11	Q1070	E9	R391	B6	R490	E4	R590	C8	R1065	E8	U310	C3
J520	E11	Q1075	E9	R392	B6	R492	E3	R591	C8	R1067	D8	U320	C2
J535	E11	Q1084	E10	R394	B6	R493	D3	R592	D8	R1068	E8	U325	B2
J575	F5	Q1085	E10	R395	A7	R494	E3	R594	C10	R1070	D9	U395	B6
J576	F6	Q1094	D10	R397	B7	R496	E3	R595	C10	R1071	D9	U415	C6
		Q1095	D10	R398	B8	R497	D3	R597	C9	R1073	E9	U425	B5
K454	D3	R302	C5	R399	B7	R499	F4	R598	C10	R1074	E8	U440	D5
		R303	C5	R400	A7	R501	F5	R599	D10	R1075	F9	U450	D4
LR1015	B8	R304	B4	R402	B7	R503	E5	R1000	C7	R1076	F9	U465	D2
LR1065	E8	R306	C4	R404	B7	R506	F5	R1001	B7	R1078	E9	U470	E2
		R307	B4	R405	B7	R507	E6	R1002	B8	R1080	E9	U545	E6
P320	D2	R309	C3	R406	B7	R509	E6	R1003	C8	R1081	E9	U565	D6
P366	A6	R312	C3	R408	B6	R511	E5	R1004	C8	R1081	E9	U575	D5
P439	C7	R313	C3	R410	B6	R512	E5	R1005	C9	R1083	E10		
P456	B1	R314	C3	R412	C7	R514	E5	R1006	C9	R1084	F9	VR489	E4
P465	C2	R316	C2	R413	C7	R515	F8	R1007	B8	R1085	E10	VR597	D9
P515	F8	R317	C2	R414	C7	R516	E11	R1009	B8	R1086	F9		
P1045	C11	R320	B2	R415	C7	R517	E11	R1010	C9	R1087	D11		
P1095	D12	R322	A2	R417	C6	R518	E11	R1012	C7	R1088	E10		
		R324	B2	R419	C6	R520	E11	R1013	C8	R1089	D11		
Q315	C2	R326	B3	R421	C5	R521	E11	R1015	A8	R1090	D10		
Q340	A4	R328	B1	R421	C5	R523	E11	R1017	C9	R1093	E9		
Q345	C3	R329	B3	R422	C6	R525	E9	R1018	C8	R1094	D9		
Q350	A4	R331	B3	R424	C6	R526	E10	R1020	B8	R1095	D9		
Q355	B4	R333	B3	R425	B6	R528	E10	R1021	C9	R1096	D11		
Q360	B5	R334	B3	R426	A6	R530	F10	R1023	B9	R1097	D10		
Q365	B5	R335	B4	R428	C6	R532	F10	R1024	B8	R1098	D10		
Q370	B11	R336	B3	R431	B5	R533	F11	R1025	A8	R1099	D11		
Q380	B10	R337	B3	R433	A4	R536	E11	R1026	A9				
Q385	A11	R339	A3	R434	B4	R537	F11	R1028	B9	TP310	C3		
Q405	B7	R341	B6	R442	C5	R540	E6	R1029	B9	TP325	B2		
Q420	C6	R342	C3	R444	C4	R541	E6	R1030	B9	TP360	A6		
Q427	B5	R343	B3	R446	C5	R543	E6	R1031	A9	TP365	A6		
Q430	B4	R345	C3	R447	D4	R544	F7	R1033	B9	TP405	B7		
Q432	B4	R346	C3	R449	C4	R546	E7	R1034	A9	TP420	C6		
Q455	E3	R347	C3	R451	D3	R548	E7	R1035	B10	TP425	B4		
Q460	D2	R349	B3	R454	E2	R549	E7	R1036	A9	TP430	C6		
Q480	F4	R352	B3	R456	E3	R550	F7	R1037	C11	TP440	D2		
Q490	E3	R354	B3	R458	D3	R552	E7	R1038	B10	TP450	E4		
Q500	F5	R357	A5	R460	C3	R554	E7	R1039	C11	TP456	C2		
Q505	E5	R359	A5	R462	C2	R555	E7	R1040	C10	TP465	D2		
Q507	E5	R360	A5	R463	C2	R556	E7	R1043	C10	TP470	E2		
Q510	E5	R362	B5	R465	D2	R558	E6	R1044	C9	TP507	F6		
Q520	E11	R363	B5	R466	E1	R560	D6	R1045	C10	TP555	E7		
Q525	F10	R365	B5	R468	E2	R562	D7	R1046	C11	TP570	C6		
Q535	F11	R366	B6	R469	E2	R563	D7	R1047	C10	TP575	D2		
Q555	E7	R367	B6	R471	F1	R564	D7	R1048	C11	TP580	E4		
Q570	D6	R369	B10	R472	F2	R565	D7	R1049	C11	TP1015	B9		
Q580	E4	R370	B10	R473	E2	R567	C6	R1050	D7	TP1035	A10		
Q582	E4	R371	B11	R474	E3	R569	D6	R1051	D7	TP1045	B10		
Q1010	C8	R373	B11	R475	E6	R570	D5	R1052	E9	TP1065	E9		
Q1015	B8	R374	B11	R477	E3	R571	D5	R1053	D9	TP1085	E10		
Q1020	B9	R376	B11	R479	F3	R572	D6	R1054	D8	TP1095	E10		
Q1025	B9	R378	B10	R480	F3	R574	D6	R1055	D9				
Q1034	B10	R379	A10	R482	F3	R575	E5	R1056	D8				
Q1035	B10	R381	B10	R483	E3	R576	E5	R1057	E8				
Q1044	C10	R383	B11	R485	E3	R578	D6	R1059	E8				
Q1045	C10	R384	A10	R485	E3	R581	E4	R1060	D8				
Q1062	D8	R387	B11	R487	E4	R583	F4	R1062	D7				
						R584	E4						


POWER FROM PWR DISTRIB P3560
P439
C435 3μF +50V
C436 1μF +15V
C437 1μF +5V
C438 1μF -15V
C439 3μF -50V
FROM DATA INTERCON
Y TRIG FROM P3103-9
Y START FROM P3101-7
P465
STABILIZES RAMPS
U320 7410
U320C
U320A
U320B
U325 74121
RAMP/HOLD RATIO
Y RAMP GATE FROM U425C-8
U300 MC4044 PHASE DETECT
REF FROM P465-5
U310 μA741C
DIGITAL/DISPLAY FROM X RAMP GEN
Q315
Q340
Q345
Q350
Q355
Q360
Q365
Q370
Q380
Q385
Q405
Q420
Q427
Q430
Q432
U395 CA3046
U415 CA3046
U425A
U425C
U425 7400
(NON-STORE MODE)
(DIGITAL MODE)
PROTECTION
MILLER INTEGRATOR
BIAS LEVEL
Y RAMP TO R1000
Y RAMP TO P2120-1
TO J3630-18
TO J3630-20
Y RAMP TO D OR P INTERCON
Y RETRACE GATE TO DATA INTERCON P3103-6
V-5V 9μs
Y RAMP GATE TO U300 U310B & U575D
PP. 100mV
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
NOTE: SEE PARAPHASE & SCAN AMPS DIAG FOR DECOUPLING DETAILS
P/O X & Y RAMP GEN BOARD A10
KEEPS CRT IN STEP WITH VERT SYNC.
R7912
Y RAMP GENERATOR 5

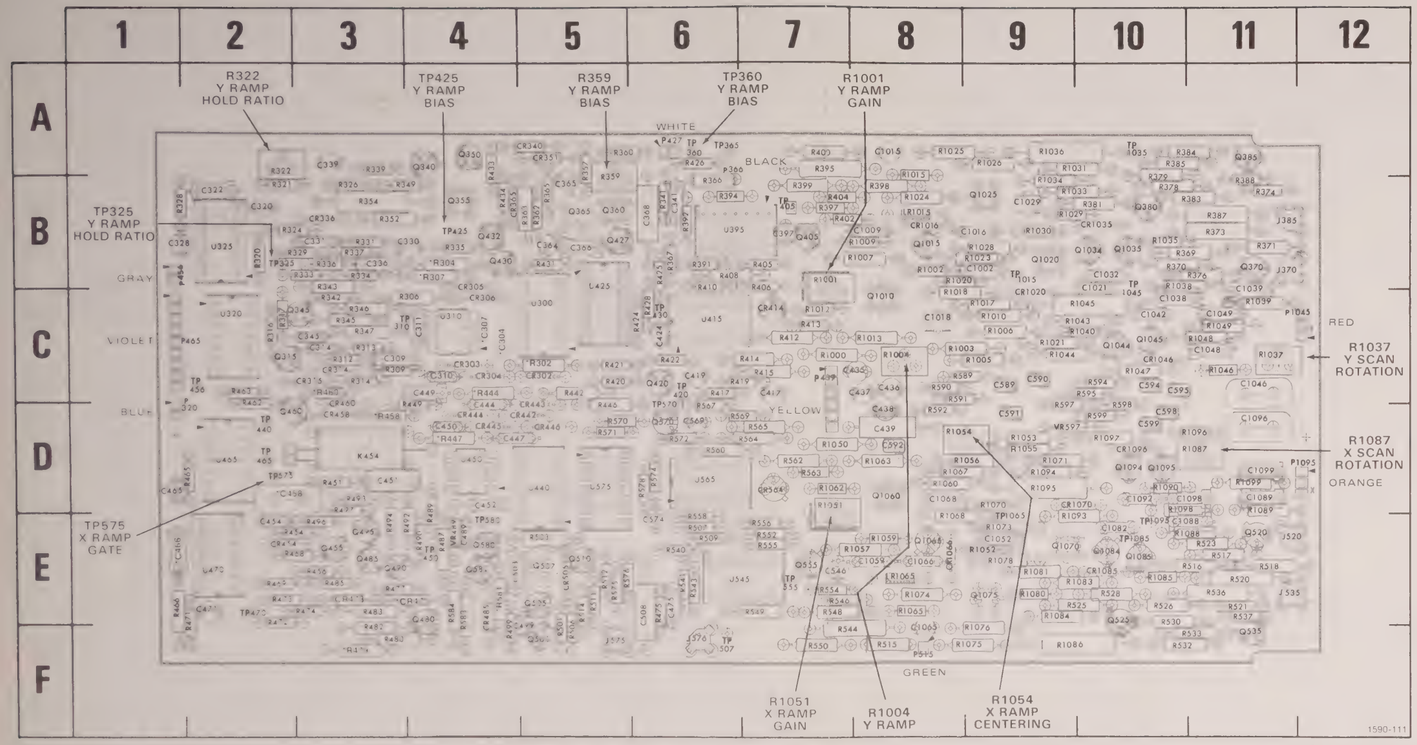
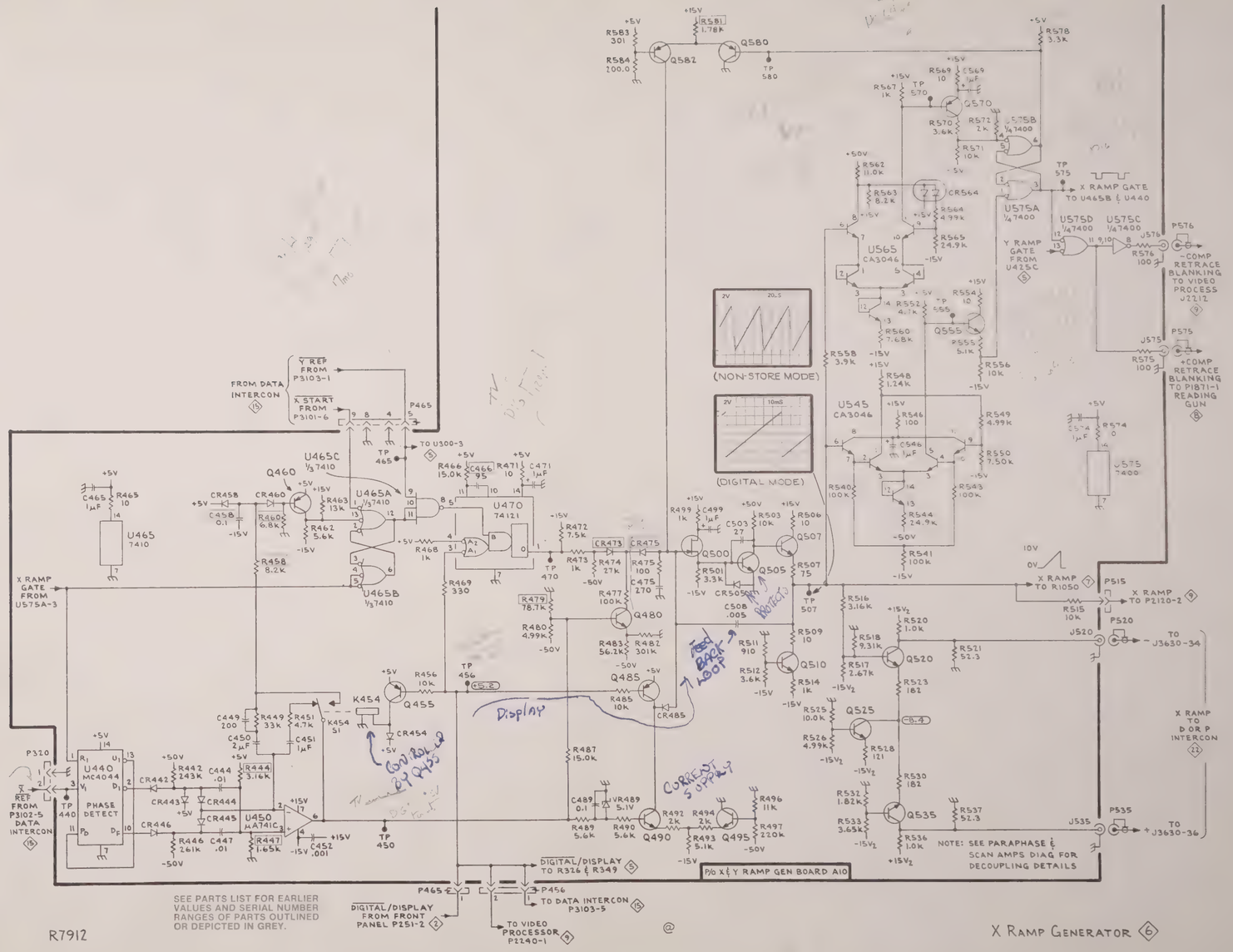


Fig. 8-9. A10 - X and Y Ramp Generators circuit board.

*See Parts List for serial number ranges.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C304	C4	C339	A3	C419	C6	C451	D3	C503	E4	C595	C10	C1032	B10	C1068	D8	CR302	C5	CR365	B4	CR460	C3	CR1066	E8
C307	C4	C341	B6	C424	C6	C452	D4	C508	F6	C598	D10	C1038	C10	C1065	F8	CR303	C4	CR414	C7	CR475	E4	CR1070	D9
C309	C3	C345	C3	C435	C8	C454	E2	C546	E7	C599	D10	C1039	B11	C1082	E10	CR304	C4	CR442	D5	CR485	F4	CR1085	E10
C310	C4	C348	D8	C436	C8	C458	D2	C569	D6	C1002	B9	C1042	C10	C1088	E10	CR305	B4	CR443	C5	CR505	E5	CR1096	D10
C311	C4	C364	B5	C437	C8	C465	D1	C574	E6	C1009	B8	C1046	C11	C1089	D11	CR306	C4	CR444	D4	CR564	D7		
C314	C3	C365	B5	C439	D8	C466	E1	C589	C9	C1015	A8	C1048	C11	C1092	D10	CR314	C3	CR445	D4	CR1016	B8		
C320	B2	C366	B5	C444	C4	C471	E2	C590	C9	C1016	B9	C1049	C11	C1096	D11	CR315	C3	CR446	D5	CR1020	C9		
C322	B2	C368	B6	C447	D4	C475	E6	C591	D9	C1018	C8	C1052	E9	C1098	D11	CR336	B3	CR454	E2	CR1035	B10		
C328	B1	C397	B7	C449	C4	C489	E4	C592	D8	C1021	B10	C1059	E8	C1099	D11	CR340	A5	CR473	E3	CR1044	C10		
C330	B4	C417	C7	C450	D4	C499	F5	C594	C10	C1029	B9	C1066	E8			CR351	A5	CR458	D3	CR1046	C10		
C331	B3																						
C336	B3																						

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
J370	B11	Q1065	E8	R388	A11	R489	E4	R589	C8	R1063	D8	U300	C5						
J385	B11	Q1070	E9	R391	B6	R490	E4	R590	C8	R1065	E8	U310	C3						
J520	E11	Q1075	E9	R392	B6	R492	E3	R591	C8	R1067	D8	U320	C2						
J535	E11	Q1084	E10	R394	B6	R493	D3	R592	D8	R1068	E8	U325	B2						
J575	F5	Q1085	E10	R395	A7	R494	E3	R594	C10	R1070	D9	U395	B6						
J576	F6	Q1094	D10	R397	B7	R496	E3	R595	C10	R1071	D9	U415	C6						
		Q1095	D10	R398	B8	R497	D3	R597	C9	R1073	E9	U425	B5						
K454	D3	R302	C5	R399	B7	R499	F4	R598	C10	R1074	E8	U440	D5						
		R303	C5	R400	A7	R501	F5	R599	D10	R1075	F9	U450	D4						
LR1015	B8	R304	B4	R402	B7	R503	E5	R1000	C7	R1076	F9	U465	D2						
LR1065	E8	R306	C4	R404	B7	R506	F5	R1001	B7	R1078	E9	U470	E2						
		R307	B4	R405	B7	R507	E6	R1002	B8	R1080	E9	U545	E6						
P320	D2	R309	C3	R406	B7	R509	E6	R1003	C8	R1081	E9	U565	D6						
P366	A6	R312	C3	R408	B6	R511	E5	R1004	C8	R1081	E9	U575	D5						
P439	C7	R313	C3	R410	B6	R512	E5	R1005	C9	R1083	E10								
P456	B1	R314	C3	R412	C7	R514	E5	R1006	C9	R1084	F9	VR489	E4						
P465	C2	R316	C2	R413	C7	R515	F8	R1007	B8	R1085	E10	VR597	D9						
P515	F8	R317	C2	R414	C7	R516	E11	R1009	B8	R1086	F9								
P1045	C11	R320	B2	R415	C7	R517	E11	R1010	C9	R1087	D11								
P1095	D12	R322	A2	R417	C6	R518	E11	R1012	C7	R1088	E10								
		R324	B2	R419	C6	R520	E11	R1013	C8	R1089	D11								
Q315	C2	R326	B3	R421	C5	R521	E11	R1015	A8	R1090	D10								
Q340	A4	R328	B1	R421	C5	R523	E11	R1017	C9	R1093	E9								
Q345	C3	R329	B3	R422	C6	R525	E9	R1018	C8	R1094	D9								
Q350	A4	R331	B3	R424	C6	R526	E10	R1020	B8	R1095	D9								
Q355	B4	R333	B3	R425	B6	R528	E10	R1021	C9	R1096	D11								
Q360	B5	R334	B3	R426	A6	R530	F10	R1023	B9	R1097	D10								
Q365	B5	R335	B4	R428	C6	R532	F10	R1024	B8	R1098	D10								
Q370	B11	R336	B3	R431	B5	R533	F11	R1025	A8	R1099	D11								
Q380	B10	R337	B3	R433	A4	R536	E11	R1026	A9										
Q385	A11	R339	A3	R434	B4	R537	F11	R1028	B9	TP310	C3								
Q405	B7	R341	B6	R442	C5	R540	E6	R1029	B9	TP325	B2								
Q420	C6	R342	C3	R444	C4	R541	E6	R1030	B9	TP360	A6								
Q427	B5	R343	B3	R446	C5	R543	E6	R1031	A9	TP365	A6								
Q430	B4	R345	C3	R447	D4	R544	F7	R1033	B9	TP405	B7								
Q432	B4	R346	C3	R449	C4	R546	E7	R1034	A9	TP420	C6								
Q455	E3	R347	C3	R451	D3	R548	E7	R1035	B10	TP425	B4								
Q460	D2	R349	B3	R454	E2	R549	E7	R1036	A9	TP430	C6								
Q480	F4	R352	B3	R456	E3	R550	F7	R1037	C11	TP440	D2								
Q490	E3	R354	B3	R458	D3	R552	E7	R1038	B10	TP450	E4								
Q500	F5	R357	A5	R460	C3	R554	E7	R1039	C11	TP456	C2								
Q505	E5	R359	A5	R462	C2	R555	E7	R1040	C10	TP465	D2								
Q507	E5	R360	A5	R463	C2	R556	E7	R1043	C10	TP470	E2								
Q510	E5	R362	B5	R465	D2	R558	E6	R1044	C9	TP507	F6								
Q520	E11	R363	B5	R466	E1	R560	D6	R1045	C10	TP555	E7								
Q525	F10	R365	B5	R468	E2	R562	D7	R1046	C11	TP570	C6								
Q535	F11	R366	B6	R469	E2	R563	D7	R1047	C10	TP575	D2								
Q555	E7	R367	B6	R471	F1	R564	D7	R1048	C11	TP580	E4								
Q570	D6	R369	B10	R472	F2	R565	D7	R1049	C11	TP1015	B9								
Q580	E4	R370	B10	R473	E2	R567	C6	R1050	D7	TP1035	A10								
Q582	E4	R371	B11	R474	E3	R569	D6	R1051	D7	TP1045	B10								
Q1010	C8	R373	B11	R475	E6	R570	D5	R1052	E9	TP1065	E9								
Q1015	B8	R374	B11	R477	E3	R571	D5	R1053	D9	TP1085	E10								
Q1020	B9	R376	B11	R479	F3	R572	D6	R1054	D8	TP1095	E10								
Q1025	B9	R378	B10	R480	F3	R574	D6	R1055	D9										
Q1034	B10	R379	A10	R482	F3	R575	E5	R1056	D8										
Q1035	B10	R381	B10	R483	E3	R576	E5	R1057	E8										
Q1044	C10	R383	B11	R485	E3	R578	D6	R1059	E8										
Q1045	C10	R384	A10	R485	E3	R581	E4	R1060	D8										
Q1062	D8	R387	B11	R487	E4	R583	F4	R1062	D7										
						R584	E4												


R7912
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
X Ramp Generator 6
P/O X & Y RAMP GEN BOARD A10
NOTE: SEE PARAPHASE & SCAN AMPS DIAG FOR DECOUPLING DETAILS
(NON-STORE MODE)
(DIGITAL MODE)
FROM DATA INTERCON 13
Y REF FROM P3103-1
X START FROM P3101-6
P465
TO U300-3 5
X RAMP GATE FROM U575A-3
X RAMP GATE TO U465B & U440
Y RAMP GATE FROM U425C 5
X RAMP TO R1050 7
X RAMP TO P2120-2 9
TO J3630-34
X RAMP TO D OR P INTERCON 22
TO J3630-36
-COMP RETRACE BLANKING TO VIDEO PROCESS U2212 9
+COMP RETRACE BLANKING TO P1871-1 READING GUN 6
P576
P575
P515
P520
P535
J520
J535
J575
J576
U465 7410
U465A 1/3 7410
U465B 1/3 7410
U465C 1/3 7410
U470 74121
U545 CA3046
U565 CA3046
U575A 1/4 7400
U575B 1/4 7400
U575C 1/4 7400
U575D 1/4 7400
U440 MC4044 PHASE DETECT
U450 μA741C
Q460
Q455
Q480
Q485
Q490
Q495
Q500
Q505
Q507
Q510
Q520
Q525
Q535
Q555
Q570
Q580
Q582
K454
CR454
CR458
CR460
CR442
CR443
CR444
CR445
CR446
CR464
CR473
CR475
CR485
VR489 5.1V
TP 440
TP 450
TP 456
TP 465
TP 470
TP 507
TP 570
TP 575
TP 580
P320
REF FROM P3102-5 DATA INTERCON 15
DIGITAL/DISPLAY TO R326 & R349 5
DIGITAL/DISPLAY FROM FRONT PANEL P2151-2 2
P465
P456
TO DATA INTERCON P3103-5 15
TO VIDEO PROCESSOR P2140-1 9
Display
Feed BACK LOOP
Control by Q455
CORRECT 5 SUPPLY?
TV Display
TV Ground
95° Focus
TV Vert Out
TV Horiz Out
TV Blank Out
TV Video Out
TV Sync

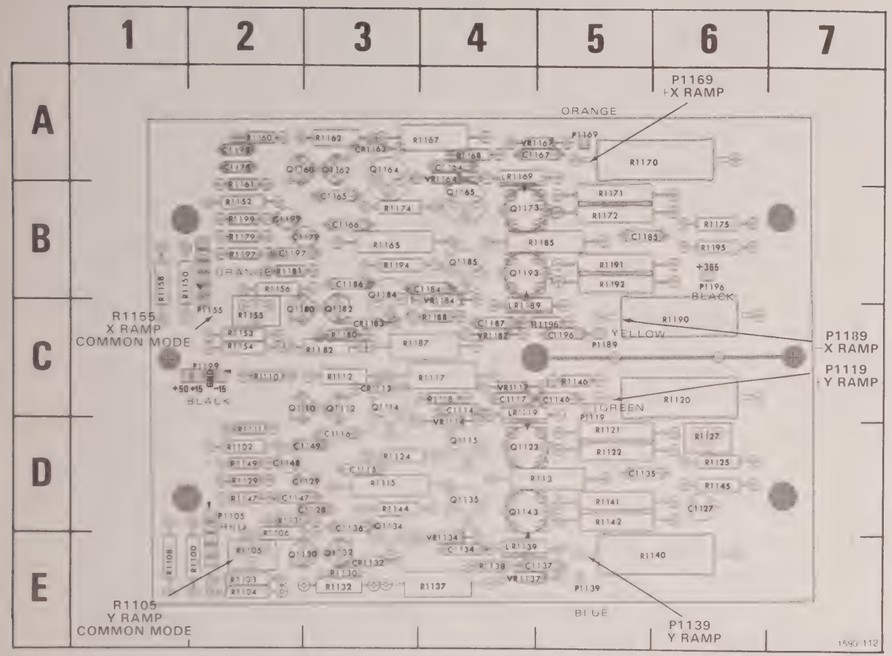
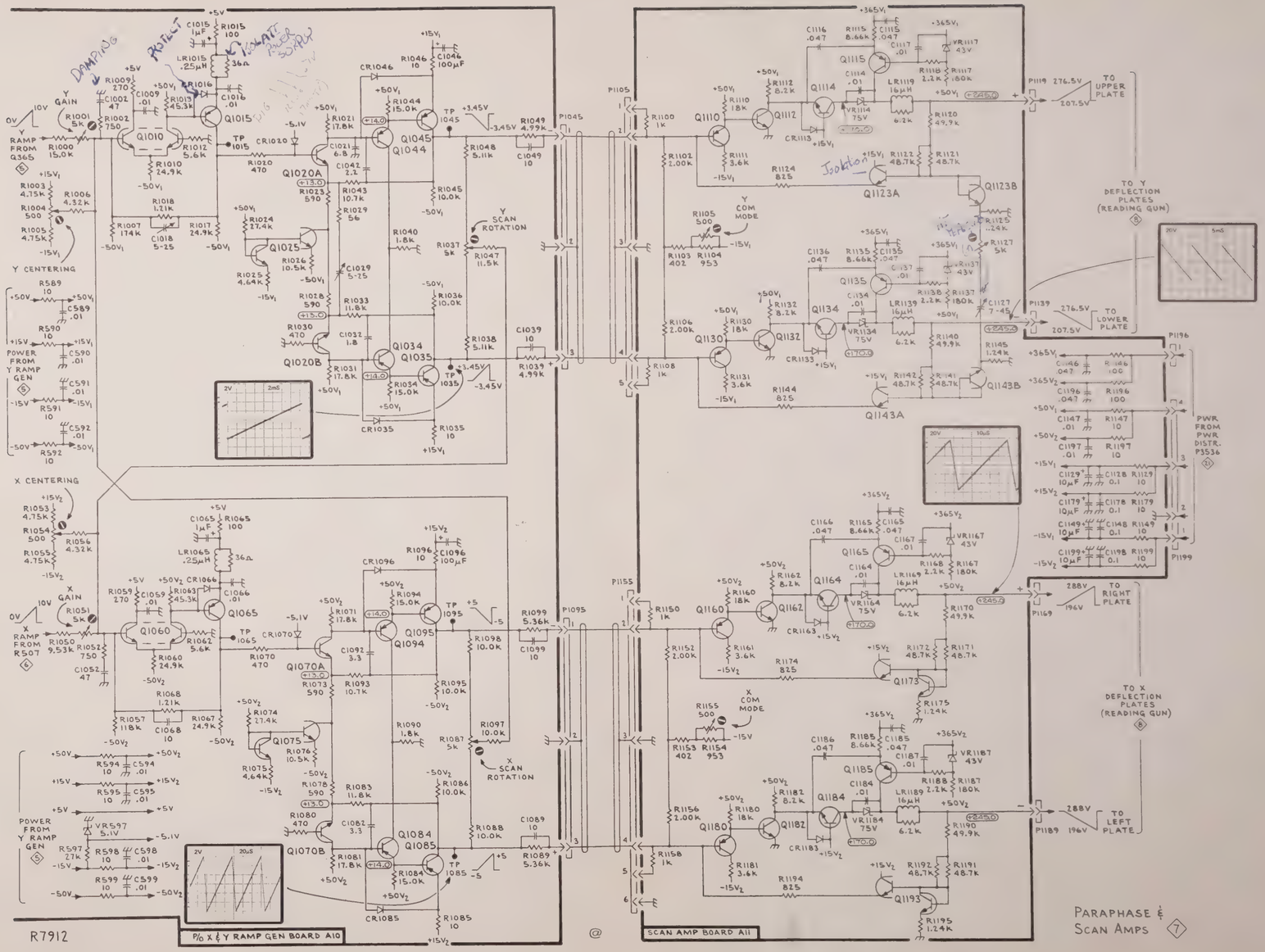
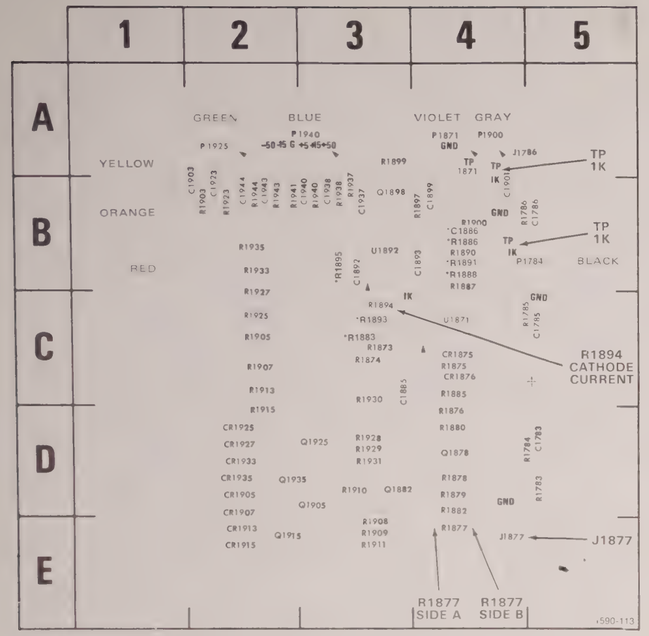


Fig. 8-10. A11—Scan Amplifier circuit board.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C1114	C4	P1105	D2	R1111	D1	R1171	B5
C1115	D3	P1119	D5	R1112	C3	R1172	B5
C1116	D3	P1139	E5	R1115	D3	R1174	B3
C1117	C4	P1155	C2	R1117	C4	R1175	B6
C1127	D6	P1169	A5	R1118	C4	R1179	B2
C1128	D3	P1189	C5	R1120	C6	R1180	C3
C1129	D3	P1196	B6	R1121	D5	R1181	B2
C1135	D5	P1199	C2	R1122	D5	R1182	C3
C1136	D3			R1124	D3	R1185	B5
C1147	D2	Q1110	C2	R1125	D6	R1187	C3
C1148	D2	Q1112	C3	R1127	D6	R1188	C4
C1164	A4	Q1114	C3	R1129	D2	R1190	C6
C1165	B3	Q1115	D4	R1130	E3	R1197	B2
C1166	B3	Q1123	D4	R1131	D2	R1191	B5
C1167	A4	Q1130	E2	R1132	E3	R1192	B5
C1178	A2	Q1132	E3	R1137	E4	R1194	B3
C1184	B4	Q1134	D3	R1138	E4	R1195	B6
C1185	B5	Q1135	D4	R1140	E5	R1199	B2
C1186	B3	Q1143	D4	R1141	D5	R1196	C5
C1187	C4	Q1160	A2	R1142	D5		
C1196	C5	Q1162	A3	R1144	D3	VR1114	D4
C1134	E4	Q1164	A3	R1145	D6	VR1117	C4
C1137	E4	Q1165	B4	R1146	C5	VR1134	E4
C1146	C5	Q1173	B4	R1147	D2	VR1137	E4
C1149	D3	Q1180	C2	R1149	D2	VR1164	A4
C1179	B2	Q1182	C3	R1150	B1	VR1167	A4
C1197	B2	Q1184	B3	R1152	B2	VR1184	C4
C1198	A2	Q1185	B4	R1153	C2	VR1187	C4
C1199	B2	Q1193	B4	R1154	C2		
				R1155	C2		
CR1113	C3	R113	D4	R1158	B1		
CR1132	E3	R1100	E1	R1160	A2		
CR1163	A3	R1102	D2	R1161	B2		
CR1183	C3	R1103	E2	R1162	A3		
		R1104	E2	R1165	B3		
LR1119	C4	R1105	E2	R1156	B2		
LR1139	E4	R1106	E2	R1167	A4		
LR1169	A4	R1108	E1	R1168	A4		
LR1189	C4	R1110	C2	R1170	A5		


Y GAIN
Y RAMP FROM Q365
Y CENTERING
POWER FROM Y RAMP GEN
X CENTERING
X GAIN
X RAMP FROM R507
POWER FROM Y RAMP GEN
Y COM MODE
Y SCAN ROTATION
X COM MODE
X SCAN ROTATION
TO UPPER PLATE
TO LOWER PLATE
TO RIGHT PLATE
TO LEFT PLATE
TO Y DEFLECTION PLATES (READING GUN)
TO X DEFLECTION PLATES (READING GUN)
PWR FROM PWR DISTR P3536
P/O X & Y RAMP GEN BOARD A10
SCAN AMP BOARD A11
R7912
Paraphase & Scan Amps

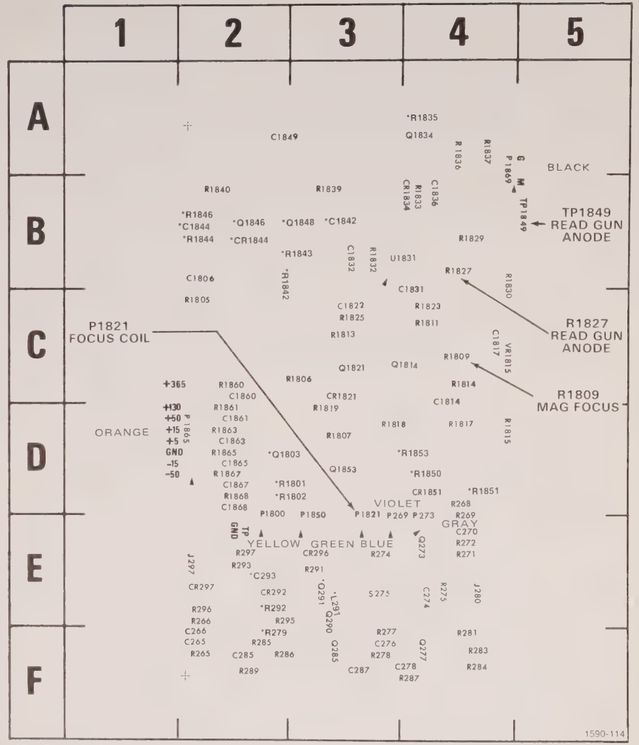


*See Parts List for serial number ranges.

Fig. 8-11. A12 Read Gun Cathode Regulator circuit board.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
		CR1844	B2										
C1783	D5	CR1875	C4	P1900	A4	R1873	C3	R1893	D3	R1925	C2	TP1871	A4
C1786	B5	CR1876	C4	P1925	A2	R1874	C3	R1894	E3	R1927	C2		
C1785	C5	CR1905	D2	P1940	A3	R1875	C4	R1895	C2	R1928	D3	U1871	C4
C1842	B3	CR1907	D2			R1876	D4	R1897	D2	R1929	D3	U1892	B3
C1885	C3	CR1913	E2	Q1878	D4	R1877	E4	R1899	B2	R1930	C3		
C1886	B4	CR1915	E2	Q1882	D3	R1878	D4	R1900	C3	R1931	D3		
C1892	B3	CR1925	D2	Q1898	B3	R1879	D4	R1903	C3	R1933	B2		
C1893	B4	CR1927	D2	Q1905	D3	R1880	D4	R1905	B3	R1935	B2		
C1899	B4	CR1933	D2	Q1915	E2	R1882	D4	R1907	B4	R1937	B3		
C1901	B4	CR1935	D2	Q1925	D3	R1883	C3	R1908	A3	R1938	B3		
C1903	B2			Q1935	D2	R1885	C4	R1909	B4	R1940	B3		
C1923	B2	J1877	E4			R1886	B4	R1910	B2	R1941	B2		
C1937	B3	J1786	A5	R1783	D5	R1887	B4	R1911	C2	R1943	B2		
C1938	B3			R1784	D5	R1888	B4	R1913	C2	R1944	B2		
C1940	B3	P1784	B5	R1785	C5	R1890	B4	R1915	E3				
C1943	B2	P1870	A4	R1786	B5	R1891	B4	R1923	E3				
C1944	B2												

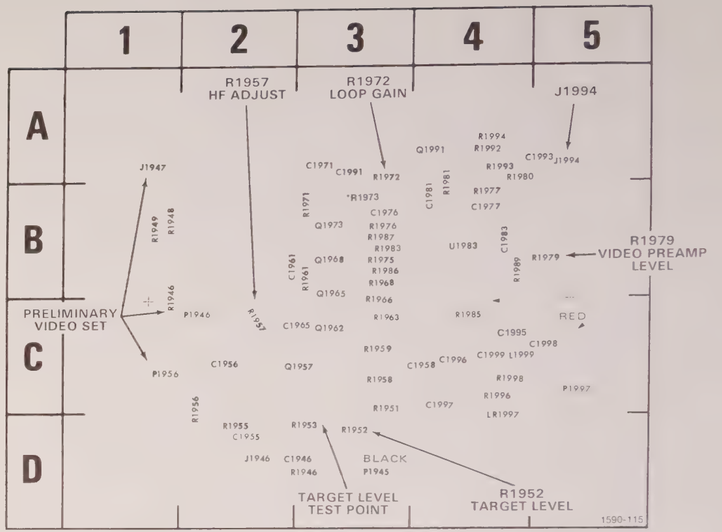
CKT NO	GRID LOC
C265	F2
C266	F2
C270	E4
C274	E4
C278	F3
C279	F3
C285	F2
C287	F3
C293	E2
C1806	B2
C1814	D4
C1817	C4
C1822	C3
C1831	C4
C1832	B3
C1836	B4
C1849	A2
C1860	C2
C1861	D2
C1863	D2
C1865	D2
C1867	D2
C1868	D2
CR292	E2
CR297	E2
CR296	E3
CR1821	C3
CR1834	B3
CR1851	D4
J280	E4
J297	E2
L291	E3
P269	E3
P273	E4
P1800	E2
P1821	E3
P1837	A4
P1850	E3
Q273	E4
Q277	F4
Q285	F3
Q290	E3
Q291	E3
Q1803	D2
Q1814	C3
Q1821	C3
Q1834	A4
Q1842	B3
Q1846	B2
Q1848	B3
Q1853	D3
R265	F2
R266	F2
R268	D4
R269	E4
R271	E4
R272	E4
R274	E3



*See Parts List for serial number ranges.

Fig. 8-12. A13—Read Gun Supply circuit board.

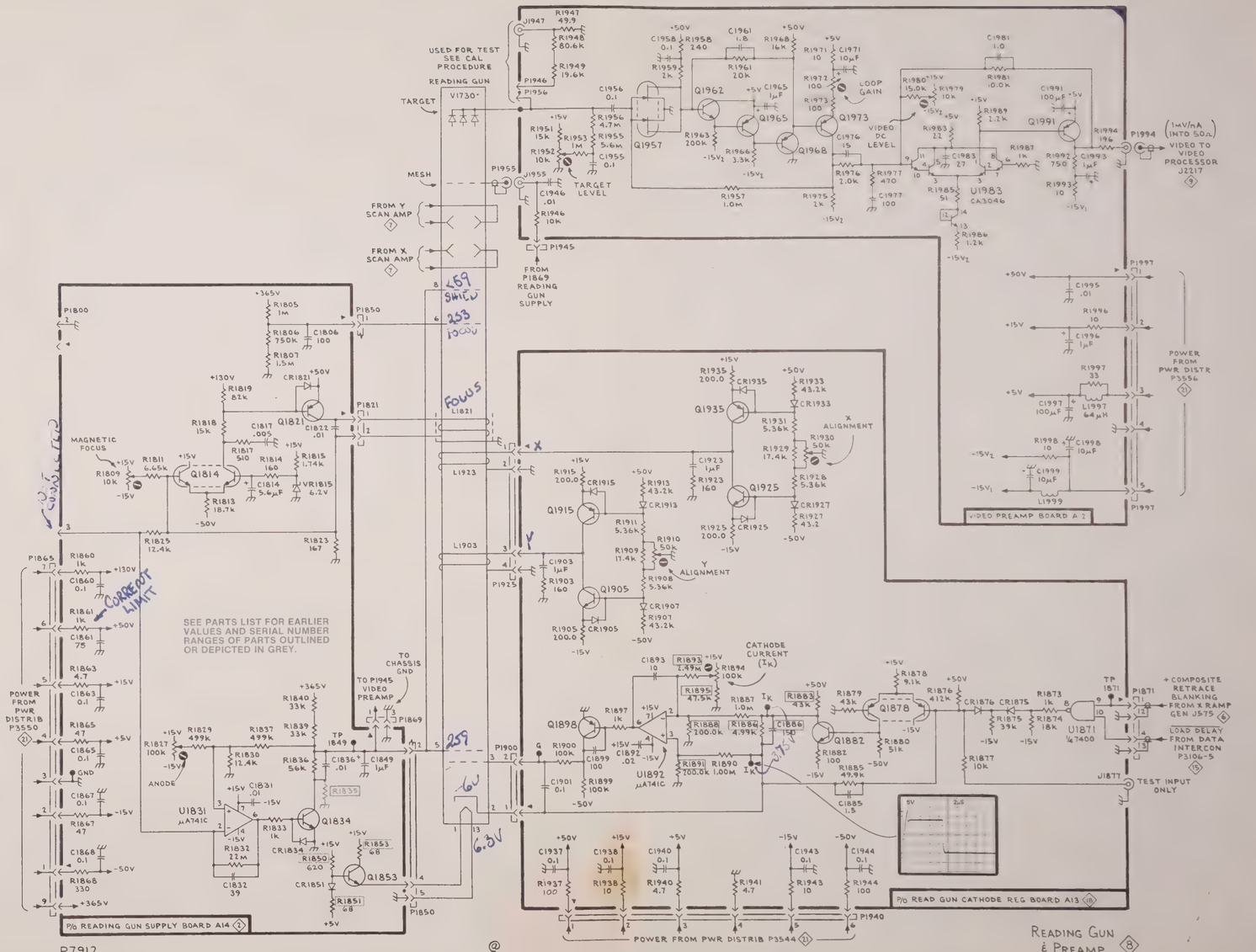
CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
R275	E4	R286	F2	R297	E2	R1815	D4	R1830	B4	R1851	D4	S275	E3
R277	F3	R287	F3	R1805	C2	R1817	D4	R1832	B3	R1853	D4		
R278	F3	R289	F2	R1806	C3	R1818	D3	R1833	B4	R1860	C2	TP1849	B5
R279	F2	R291	E3	R1807	D3	R1819	D3	R1835	A4	R1861	D2		
R281	F4	R292	E2	R1809	C4	R1823	C4	R1836	A4	R1863	D2	U1831	B3
R283	F4	R293	E2	R1811	C4	R1825	C3	R1837	A4	R1865	D2		
R284	F4	R295	F2	R1813	C3	R1827	B4	R1839	B3	R1867	D2	VR1815	C4
R285	F2	R296	E2	R1814	C4	R1829	B4	R1840	B2	R1868	D2		
								R1842	B2				
								R1843	B3				
								R1844	B2				
								R1846	B2				



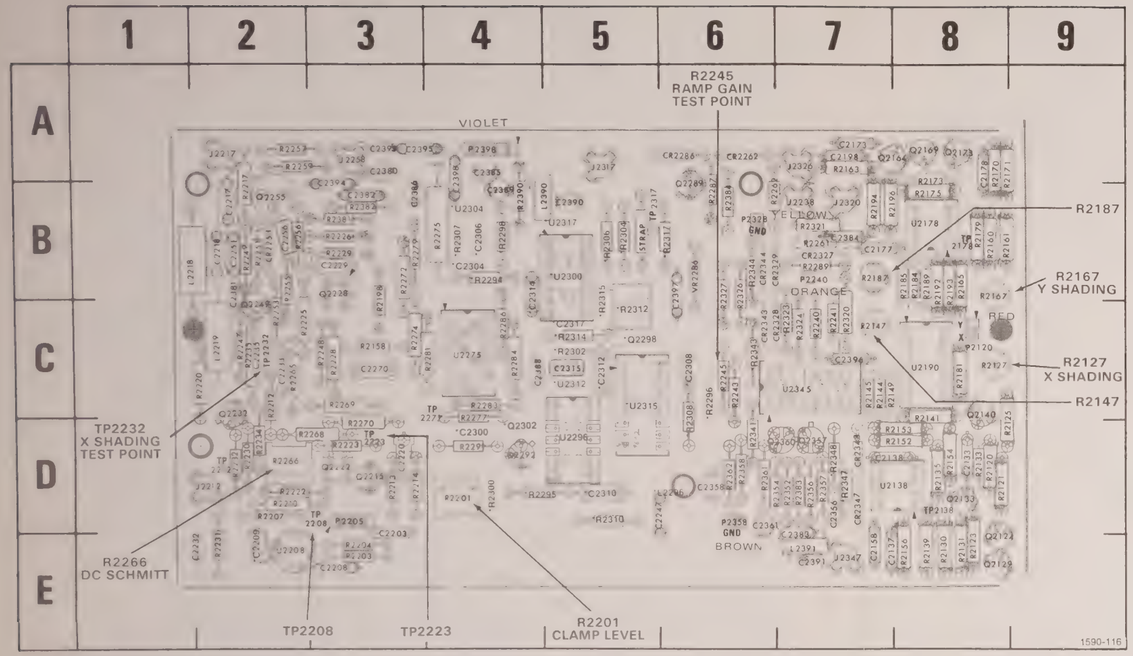
*See Parts List for serial number ranges.

Fig. 8-13. A14—Video Preamp circuit board.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C1946	D2	J1946	D2	Q1973	B3	R1966	C3	R1993	A4
C1955	D2	J1947	A1	Q1991	A4	R1968	B3	R1994	A4
C1956	C2	J1994	A5			R1971	B3	R1996	C4
C1958	C4			R1946	D3	R1972	A3	R1998	C4
C1961	B2	L1999	C4	R1947	B1	R1973	B3		
C1965	C2			R1948	B1	R1975	B3	U1983	B5
C1971	A3	LR1997	D4	R1949	B1	R1976	B3		
C1976	B3			R1951	C3	R1977	B4		
C1977	B4	P1945	D3	R1952	D3	R1979	B5		
C1981	B4	P1946	C2	R1953	D3	R1980	A4		
C1983	B4	P1956	C1	R1955	D2	R1981	B4		
C1991	A3	P1997	C5	R1956	C2	R1983	B3		
C1993	A5			R1957	C2	R1985	C4		
C1996	C4	Q1957	C2	R1958	C3	R1986	B3		
C1997	C4	Q1962	C3	R1959	C3	R1987	B3		
C1998	C5	Q1965	B3	R1961	B3	R1989	B4		
C1999	C4	Q1968	B3	R1963	C3	R1992	A4		


USED FOR TEST SEE CAL PROCEDURE
READING GUN
TARGET
MESH
FROM Y SCAN AMP
FROM X SCAN AMP
FROM P1869 READING GUN SUPPLY
TARGET LEVEL
LOOP GAIN
VIDEO DC LEVEL
U1983 CA3046
1mV/mA INTO 50Ω
VIDEO TO VIDEO PROCESSOR J2217
VIDEO PREAMP BOARD A12
POWER FROM PWR DISTR P3556
X ALIGNMENT
Y ALIGNMENT
FOCUS
MAGNETIC FOCUS
ANODE
CATHODE CURRENT (1K)
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
TO CHASSIS GND
TO P1945 VIDEO PREAMP
+ COMPOSITE RETRACE BLANKING FROM X RAMP GEN U575
LOAD DELAY FROM DATA INTERCON P3106-5
TEST INPUT ONLY
P/O READING GUN SUPPLY BOARD A14
P/O READ GUN CATHODE REG BOARD A13
POWER FROM PWR DISTRIB P3544
READING GUN & PREAMP 8

R7912



*See Parts List for serial number ranges.

Fig. 8-14. A16 -Video Processor circuit board.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C2133	D8	C2232	E2	C2380	A3	C2397	B6	J2212	D2	P2120	C8	Q2222	D3	R2130	E7	R2160	B8	R2192	B8
C2138	D7	C2233	C2	C2381	B2	C2398	A4	J2217	A2	P2205	D3	Q2228	B3	R2131	E7	R2161	B9	R2193	B8
C2137	E8	C2235	C2	C2382	B3			J2238	B7	P2270	B7	Q2232	C2	R2133	D8	R2163	A7	R2194	B7
C2158	E7	C2247	D6	C2383	E7	CR2253	B2	J2258	A3	P2328	B6	Q2249	C2	R2135	D8	R2165	B8	R2196	B8
C2173	A7	C2251	B2	C2384	B7	CR2262	A6	J2317	A5	P2358	D6	Q2255	B2	R2139	E7	R2167	B8	R2198	B3
C2177	B7	C2256	B2	C2385	A4	CR2286	A6	J2320	B7	P2398	A4	Q2289	A6	R2141	C8	R2170	A8	R2201	D4
C2178	A8	C2270	C3	C2386	B3	CR2328	C7	J2326	A7			Q2292	D4	R2144	C7	R2171	A9	R2203	E3
C2198	A7	C2304	B4	C2388	C4	CR2329	B7	J2347	E7	Q2124	E7	Q2302	D4	R2145	C7	R2173	A8	R2204	E3
C2203	E3	C2306	B4	C2389	B4	CR2343	C6			Q2129	E7	Q2357	D7	R2147	C7	R2175	B8	R2207	D2
C2208	E3	C2308	C6	C2390	B5	CR2344	B6	L2218	B1	Q2133	D8	Q2360	D7	R2149	C8	R2179	B8	R2210	D2
C2209	E2	C2310	D5	C2391	E7	CR2347	D7	L2219	C2	Q2140	C8			R2152	D8	R2181	C8	R2212	C2
C2217	B2	C2312	C5	C2393	A3	CR2348	D7	L2296	D6	Q2164	A8	R2120	D8	R2153	D8	R2184	B8	R2213	D3
C2218	B2	C2314	B4	C2394	A3			L2390	B5	Q2169	A8	R2121	D8	R2154	D8	R2185	B8	R2214	D3
C2220	D3	C2315	C5	C2395	A3			L2391	E7	Q2173	A8	R2123	E7	R2156	E7	R2187	B7	R2217	B2
C2229	B3	C2317	C5	C2396	C7					Q2215	D3	R2125	D9	R2158	C3	R2189	B8	R2220	C2
		C2356	D7									R2127	C8						
		C2358	D6																
		C2361	D6																

CKT NO	GRID LOC	CKT NO	GRID LOC
R2222	D2	R2343	C6
R2223	D3	R2344	B6
R2225	C2	R2347	D7
R2226	B3	R2348	D7
R2228	C3	R2352	D7
R2229	B3	R2354	D7
R2230	D2	R2356	D7
R2231	E2	R2357	D7
R2232	D2	R2358	D6
R2234	D2	R2361	D6
R2235	C2	R2362	D6
R2240	C7	R2381	B3
R2241	C7	R2382	B3
R2243	C6	R2383	D7
R2245	C6	R2384	B6
R2247	C2	R2390	B4
R2248	C3	TP2138	D8
R2249	B2	TP2178	B8
R2251	B2	TP2208	D3
R2253	C2	TP2212	D2
R2255	B2	TP2223	D3
R2256	B2	TP2232	C2
R2257	A2	TP2277	C4
R2259	A2	TP2317	B5
R2261	B7		
R2262	B7	U2138	D8
R2265	C2	U2178	B8
R2266	D2	U2190	C8
R2268	D3	U2208	E2
R2269	C3	U2275	C4
R2270	D3	U2296	D5
R2272	B3	U2300	B5
R2274	C3	U2304	B4
R2275	B4	U2312	C5
R2277	C4	U2315	C5
R2279	B3	U2317	B5
R2281	C4	U2345	C7
R2283	C4		
R2284	C4	VR2286	B6
R2286	C4		
R2287	B6		
R2289	B7		
R2291	D4		
R2296	C6		
R2294	B4		
R2295	D5		
R2298	B4		
R2302	C5		
R2304	B5		
R2306	B5		
R2307	B4		
R2308	C6		
R2310	D5		
R2312	C5		
R2314	C5		
R2315	C5		
R2317	B6		
R2320	C7		
R2321	B7		
R2323	C7		
R2324	C7		
R2326	B6		
R2327	B6		
R2341	D6		

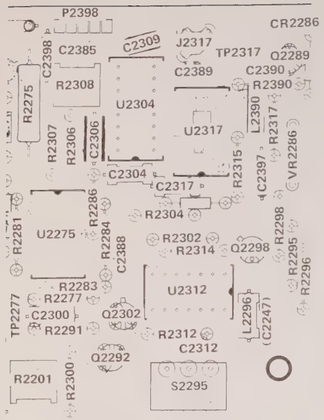
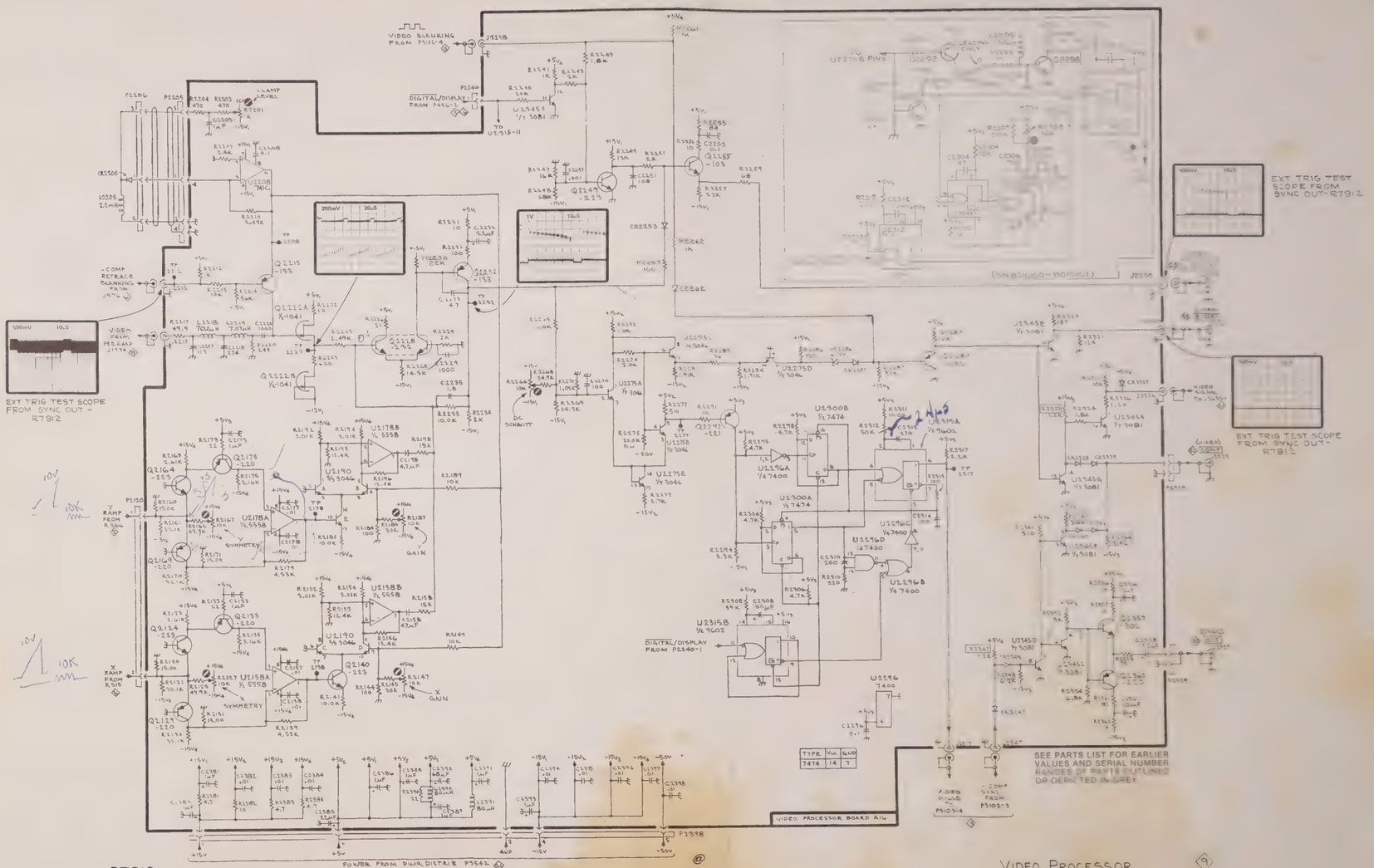
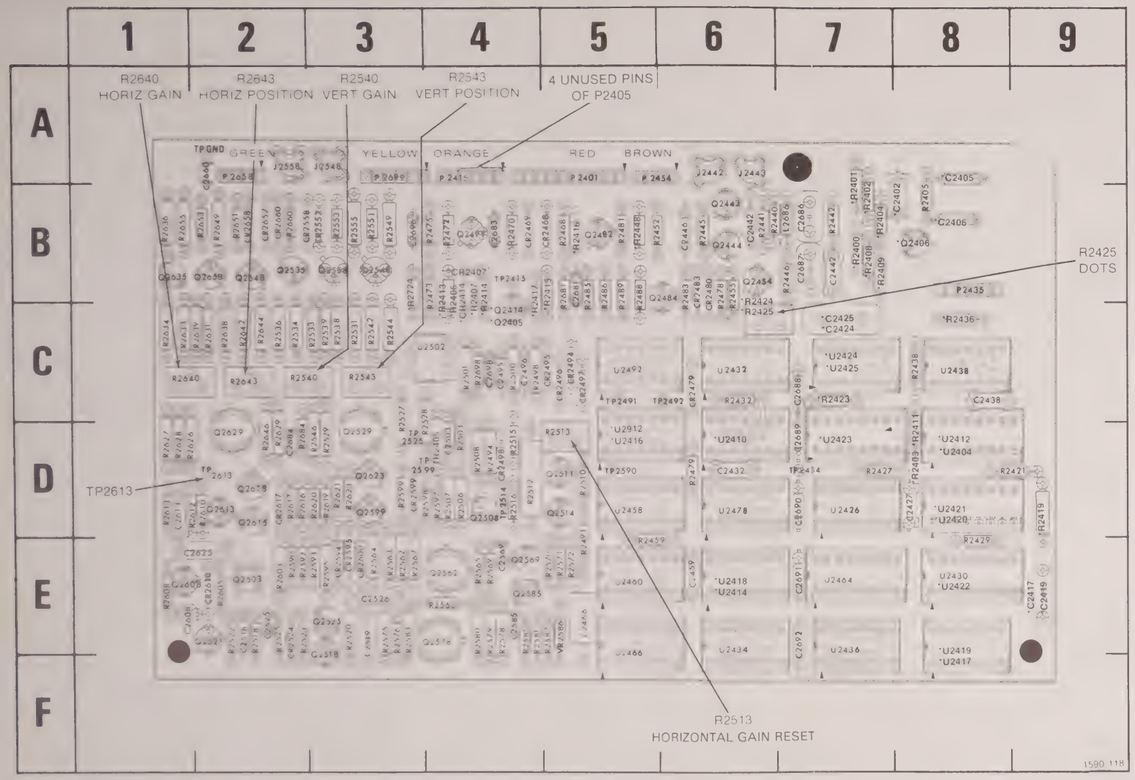


Fig.8-14A A16–Partial Video Processor circuit board. (SN B010100–B010111)


VIDEO BLANKING FROM P5101-4
DIGITAL/DISPLAY FROM P5140-2
TO U2315-11
EXT TRIG TEST SCOPE FROM SYNC OUT-R7912
EXT TRIG TEST SCOPE FROM SYNC OUT - R7912
VIDEO FROM PREAMP
-COMP RETRACE BLANKING FROM U5470
V RAMP FROM R5160
X RAMP FROM R5181
DC SCHMITT
SYMMETRY
GAIN
DIGITAL/DISPLAY FROM P5140-1
VIDEO BLANK TO P5105-4
-COMP SYNC FROM P5103-3
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY
VIDEO PROCESSOR BOARD A1G
POWER FROM PWR DISTRIB P5562
R7912
VIDEO PROCESSOR

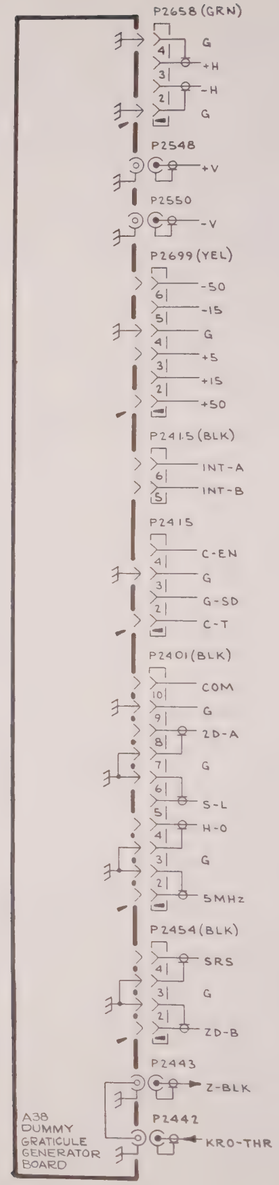


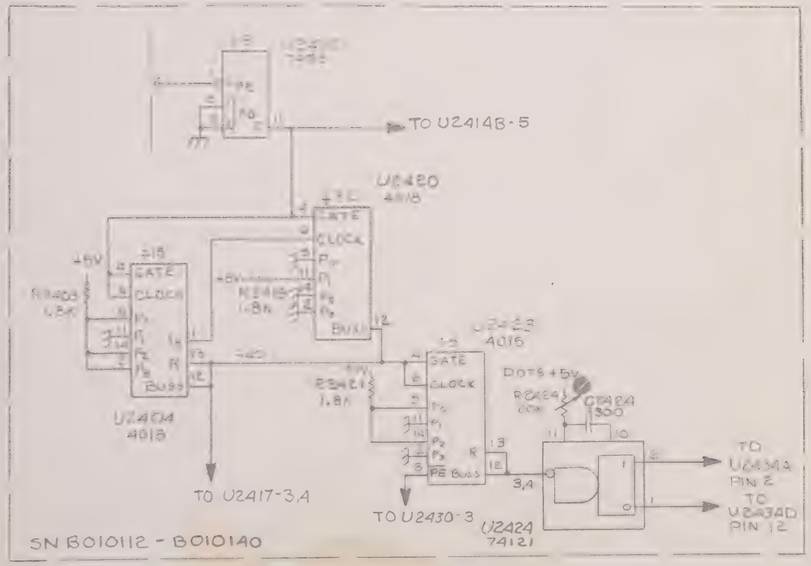
*See Parts List for serial number ranges.

Fig. 8-15. A17 Graticule Generator circuit board.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C2402	B8	C2519	E3	C2692	E7	CR2558	B2	P2401	A5	Q2518	F3	Q2623	D3	R2414	B4	R2448	B5	R2491	E5
C2405	A8	C2525	E2	C2696	B3	CR2594	E3	P2415	A4	Q2521	E2	Q2629	D2	R2415	B5	R2452	B5	R2494	D4
C2406	B8	C2526	E3	C2698	C4	CR2595	E3	P2454	A5	Q2525	E3	Q2635	B1	R2416	B5	R2455	B6	R2498	C4
C2417	F8	C2569	E3	CR2407	B4	CR2599	D3	P2658	A2	Q2529	D3	Q2648	B2	R2419	D9	R2459	E5	R2500	C4
C2419	C4	C2585	E4	CR2414	B4	CR2600	E3	P2699	A3	Q2535	B2	Q2658	B2	R2421	D9	R2468	B5	R2501	C4
C2424	C1	C2608	E1	CR2442	B6	CR2610	E2	Q2405	C4	Q2548	B3	R2400	B7	R2423	C7	R2470	B4	R2503	D4
C2425	E9	C2613	D1	CR2468	B5	CR2617	D2	Q2406	B8	Q2558	B3	R2401	A7	R2425	C6	R2472	B4	R2505	D4
C2427	C7	C2625	E2	CR2469	B4	CR2657	B2	Q2414	C4	Q2562	E4	R2402	B7	R2427	D7	R2474	B3	R2506	D4
C2432	D8	C2660	A2	CR2479	C6	CR2658	B2	Q2443	B6	Q2569	E4	R2403	D8	R2429	E8	R2475	B4	R2507	D4
C2438	D6	C2681	B5	CR2480	B6	CR2660	B2	Q2444	B6	Q2578	E4	R2404	B7	R2432	C6	R2478	B6	R2508	D4
C2442	C8	C2683	B4	CR2483	B6	J2442	A6	Q2454	B6	Q2585	E4	R2405	B8	R2435	B8	R2479	D6	R2510	D5
C2446	B7	C2684	D2	CR2494	C5	J2443	A6	Q2471	B4	Q2599	D3	R2406	B4	R2436	C8	R2481	B5	R2512	D4
C2459	B6	C2686	B7	CR2495	C5	J2548	A3	Q2482	B5	Q2603	E2	R2407	B4	R2438	C8	R2483	B6	R2513	D5
C2466	E6	C2687	B7	CR2496	C5	J2558	A2	Q2484	B6	Q2608	E1	R2408	B7	R2440	B6	R2485	B5	R2515	D4
C2495	E5	C2688	C7	CR2498	D4			Q2508	D4	Q2613	D2	R2409	B7	R2441	B6	R2486	B5	R2516	D4
C2496	C4	C2689	D7	CR2524	E2	L2686	B7	Q2511	D5	Q2615	D2	R2411	D8	R2442	B7	R2488	B5	R2518	E2
C2503	D4	C2690	D7	CR2557	B3			Q2514	D5	Q2618	D2	R2413	B4	R2445	B6	R2489	B5	R2520	E3
C2518	E2	C2691	E7											R2446	B7			R2522	E2

CKT NO	GRID LOC	CKT NO	GRID LOC
R2523	E2	R2640	C1
R2525	E2	R2642	C2
R2527	D3	R2643	C2
R2528	D3	R2644	C2
R2529	D3	R2646	D2
R2531	C3	R2649	B2
R2533	C3	R2651	B2
R2534	C2	R2653	B2
R2536	C2	R2655	B1
R2538	C3	R2660	B2
R2539	C3	R2681	B5
R2540	C2	R2684	D2
R2542	C3	R2698	C4
R2543	C3		
R2544	C3	TP2415	B4
R2546	D3	TP2434	D7
R2549	B3	TP2491	C5
R2551	B3	TP2492	C6
R2555	B3	TP2514	D4
R2553	B3	TP2525	D3
R2560	E4	TP2590	D5
R2562	E3	TP2599	D3
R2563	E3	TP2613	D2
R2564	E3		
R2565	E4	U2404	D8
R2567	E3	U2410	D6
R2569	E4	U2412	D8
R2570	E5	U2416	D5
R2571	E5	U2417	F8
R2572	E5	U2418	E6
R2575	E3	U2419	E8
R2576	E3	U2421	D8
R2578	E4	U2422	E8
R2579	E4	U2423	D7
R2580	E4	U2424	C7
R2581	E4	U2425	C7
R2583	E3	U2426	D7
R2585	E4	U2430	E8
R2587	E5	U2432	C6
R2590	E2	U2434	E6
R2592	E2	U2436	E7
R2593	E3	U2438	C8
R2595	E3	U2458	D5
R2597	D4	U2460	E5
R2598	D3	U2464	E7
R2599	D3	U2466	F5
R2603	E2	U2478	D6
R2605	E2	U2492	C5
R2608	E1	U2502	C4
R2610	D2	U2912	D5
R2612	D1	VR2586	E5
R2613	D1		
R2616	D2		
R2617	D2		
R2619	D3		
R2620	D3		
R2621	D3		
R2623	D3		
R2626	D1		
R2627	D1		
R2628	D1		
R2629	D2		
R2631	C2		
R2633	C1		
R2634	C1		
R2636	B1		
R2638	C2		
R2639	C2		





R7912

SEE CIRCUIT FOR SN B010112-B010140

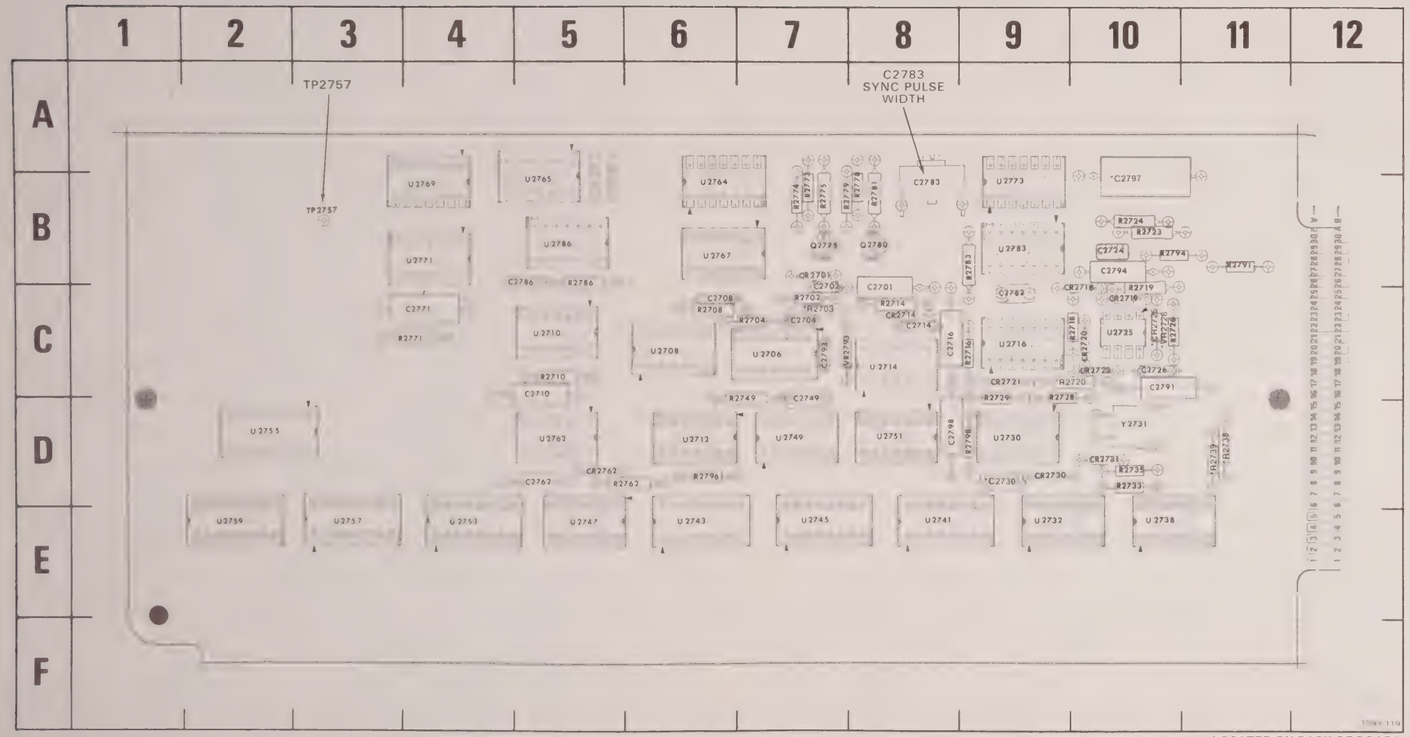
HORIZ. GAIN RESET

SEE PARTS LIST FOR EARLIER NUMBERS AND OTHER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.

GRATICULE GENERATION BOARD A17

(OPTION 6) GRATICULE GENERATOR

10

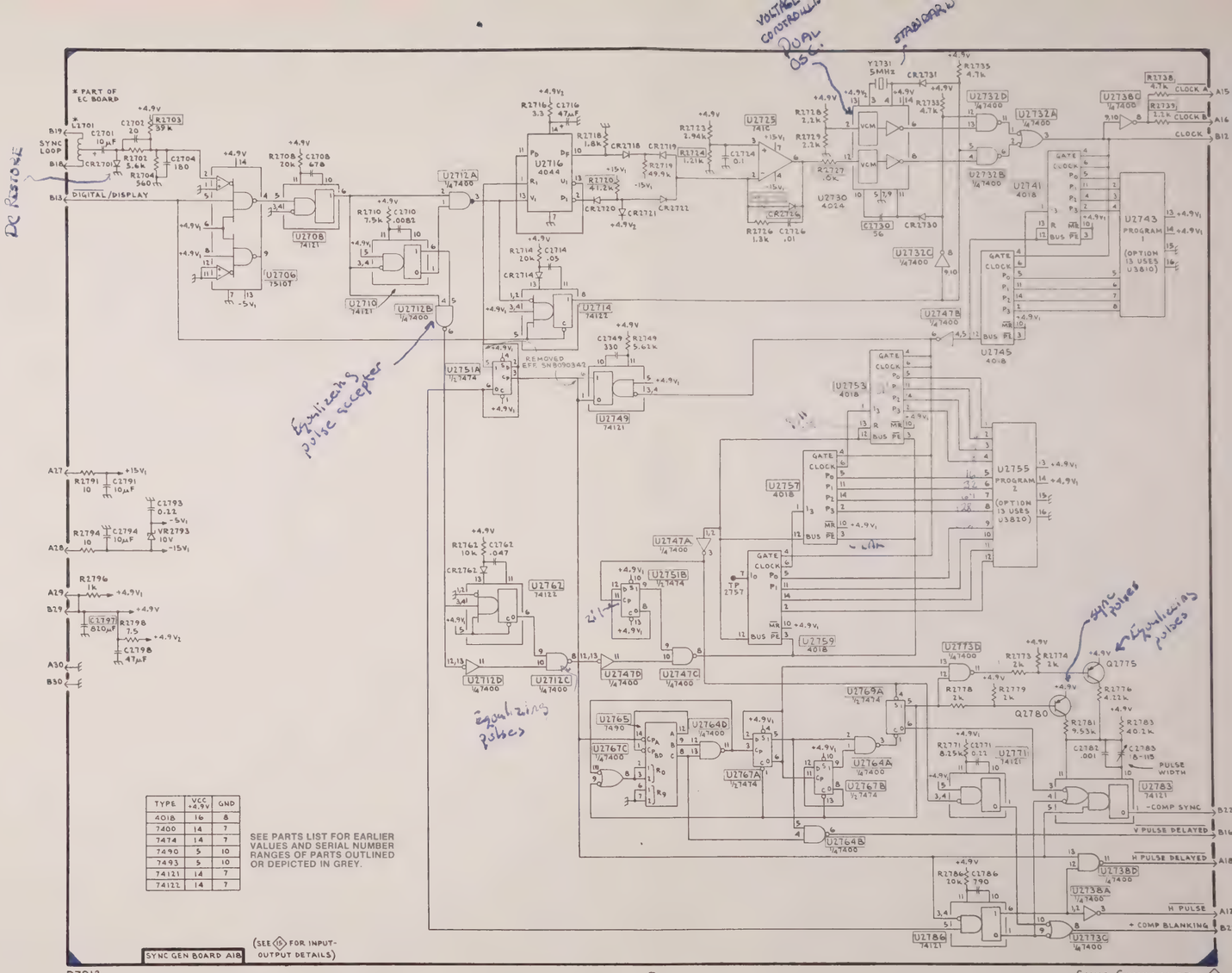


*See Parts List for serial number ranges.

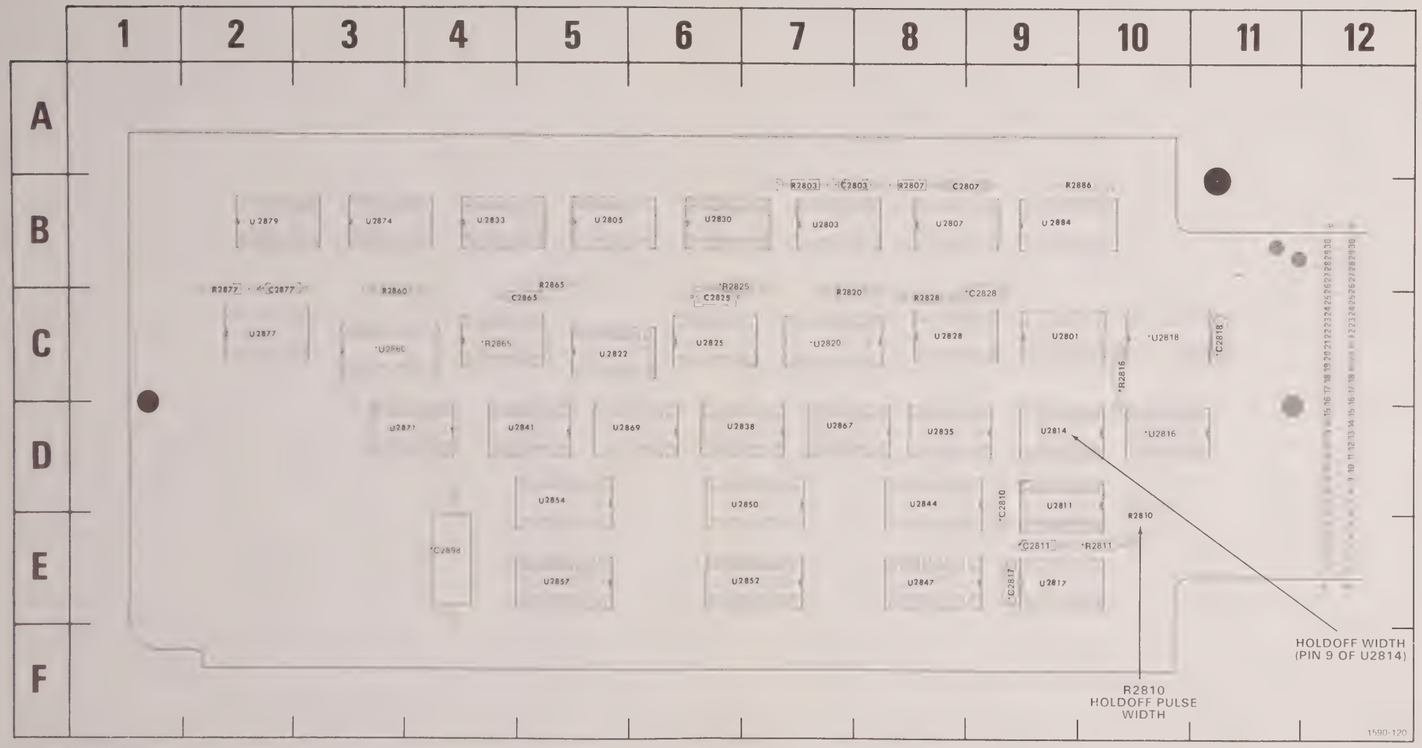
LOCATED ON BACK OF BOARD:
*R2311
*R2727

Fig. 8-16. A18—Sync Generator circuit board.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C2701	C8	CR2701	B7	R2718	C9	R2783	B9	U2745	E7
C2702	C7	CR2714	C8	R2719	C10	R2786	B5	U2747	E5
C2704	C7	CR2718	C10	R2720	C9	R2791	B11	U2749	D7
C2708	C6	CR2719	C10	R2723	B10	R2794	B10	U2751	D8
C2710	C5	CR2720	C10	R2724	B10	R2796	D6	U2753	E4
C2714	C8	CR2721	C9	R2726	C10	R2798	D9	U2755	D2
C2716	C8	CR2722	C10	R2728	C9			U2757	E3
C2724	B10	CR2726	C10	R2729	C9	TP2752	B3	U2759	E2
C2726	C10	CR2730	D9	R2733	D10			U2762	D5
C2730	D9	CR2731	D10	R2735	D10	U2706	C7	U2764	B6
C2749	C7	CR2762	D5	R2738	D11	U2708	C6	U2765	B5
C2762	D5	Q2775	B7	R2739	D11	U2710	C5	U2767	B6
C2771	C4	Q2780	B8	R2749	C7	U2712	D6	U2769	B4
C2782	C9			R2762	D5	U2716	C9	U2771	B4
C2783	B8	R2702	C7	R2771	C4	U2714	C8	U2773	B9
C2786	B5	R2703	C7	R2773	B7	U2725	C10	U2783	B9
C2791	C10	R2704	C7	R2774	B7	U2730	D9	U2786	B5
C2793	C7	R2708	C6	R2775	B7	U2732	E9		
C2794	B10	R2710	C5	R2778	B8	U2738	E10	VR2726	C10
C2797	B10	R2714	C8	R2779	B7	U2741	E8	VR2793	C7
C2798	D8	R2716	C9	R2781	B8	U2743	E6		
								Y2731	D10



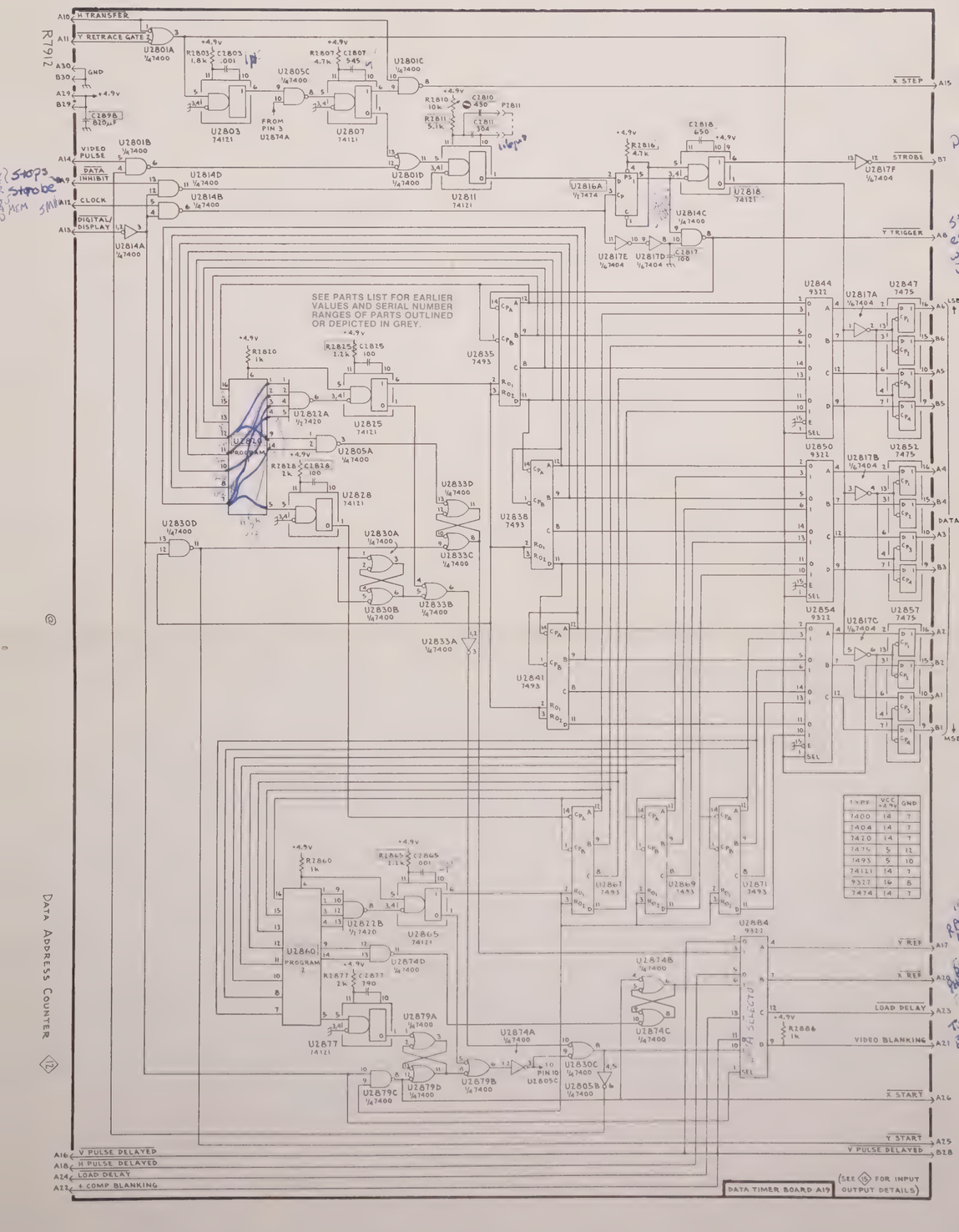
TYPE	VCC +4.9V	GND
4018	16	8
7400	14	7
7474	14	7
7490	5	10
7493	5	10
74121	14	7
74122	14	7

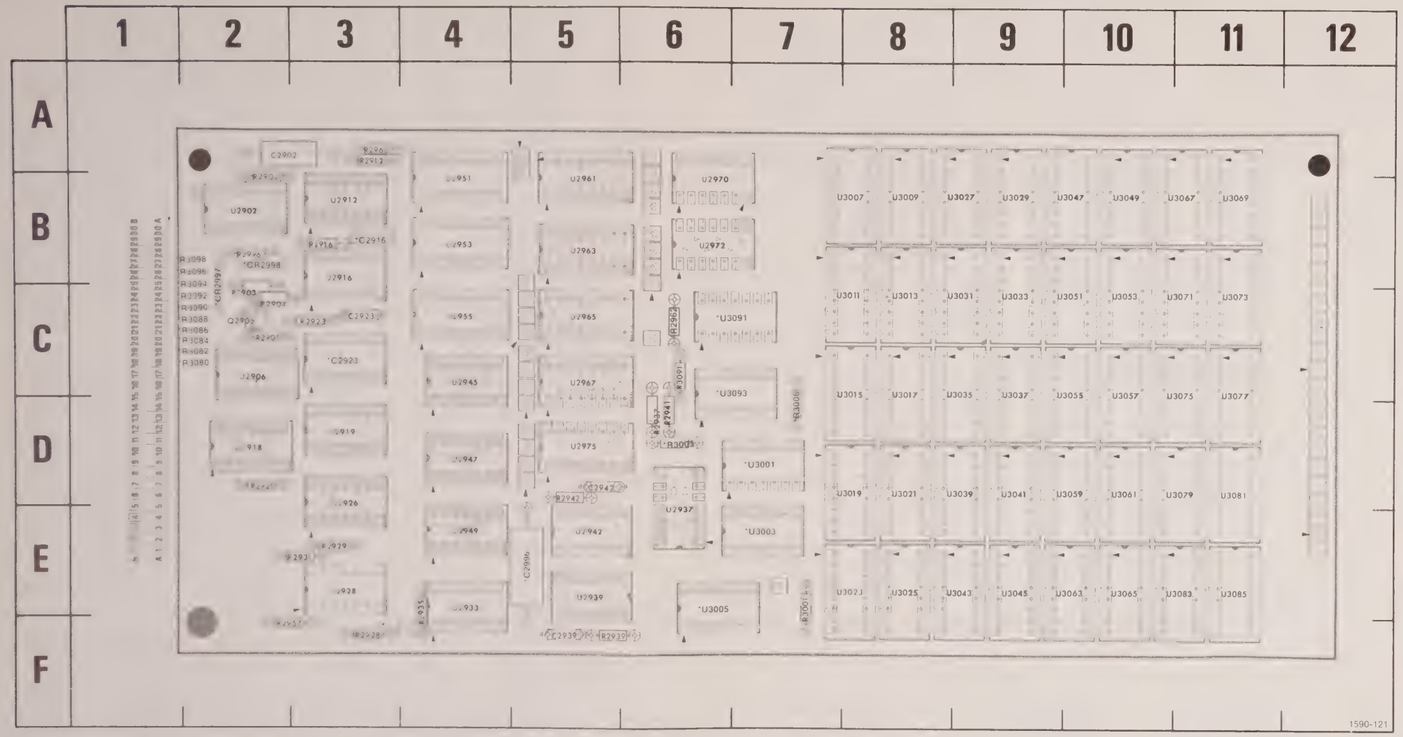


*See Parts List for serial number ranges.

Fig. 8-17. A19—Data Address Counter circuit board.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C2803	B7	R2803	B7	U2801	C9	U2841	D5
C2807	B8	R2807	B8	U2803	B7	U2844	D8
C2810	D9	R2810	E10	U2805	B5	U2847	E8
C2811	E9	R2811	E10	U2807	B8	U2850	D6
C2817	E9	R2816	C10	U2811	D9	U2852	E7
C2818	C11	R2820	C7	U2814	D9	U2854	D5
C2825	C6	R2825	C6	U2816	D10	U2857	E5
C2828	C9	R2828	C8	U2817	E9	U2860	C3
C2877	C2	R2860	C3	U2818	C10	U2865	C4
C2898	E4	R2865	C5	U2820	C7	U2867	D7
		R2865	C5	U2822	C5	U2869	D5
P2811	E7	R2877	C2	U2825	C6	U2871	D3
		R2886	B9	U2828	C8	U2874	B3
				U2830	B6	U2877	C2
				U2835	D8	U2879	B2
				U2838	D6	U2884	B9


R7912
DATA ADDRESS COUNTER
H TRANSFER
V RETRACE GATE
GND
+4.9V
C2898 820μF
VIDEO PULSE
DATA INHIBIT
CLOCK
DIGITAL/ DISPLAY
U2801A ¼7400
U2801B ¼7400
U2814D ¼7400
U2814B ¼7400
U2814A ¼7400
R1803 1.8k
C1803 .001
U2803 74121
R1807 4.7k
C1807 .545
U2805C ¼7400
FROM PIN 3 U2874A
U2807 74121
U2801C ¼7400
R1810 10k
C2810 450
P1811
R1811 5.1k
C2811 304
U2801D ¼7400
U2811 74121
R1816 4.7k
U2816A ½7474
C2818 650
U2818 74121
U2814C ¼7400
U2817E ¼7404
U2817D ¼7404
C2817 100
X STEP
STROBE
Y TRIGGER
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
R1820 1k
R1815 1.2k
C2815 100
U2821A ½7420
U2825 74121
U2819 PROGRAM
U2805A ¼7400
R1818 2k
C1818 100
U2828 74121
U2830D ¼7400
U2830A ¼7400
U2830B ¼7400
U2833D ¼7400
U2833C ¼7400
U2833B ¼7400
U2833A ¼7400
U2835 7493
U2838 7493
U2841 7493
U2844 9322
U2850 9322
U2854 9322
U2847 7475
U2852 7475
U2857 7475
U2817A ¼7404
U2817B ¼7404
U2817C ¼7404
LSB
MSB
DATA
R2860 1k
R1865 2.2k
C2865 .001
U2821B ½7420
U2865 74121
U2860 PROGRAM
U2874D ¼7400
R2877 2k
C2877 390
U2877 74121
U2879A ¼7400
U2879C ¼7400
U2879D ¼7400
U2879B ¼7400
U2874A ¼7400
U2830C ¼7400
U2805B ¼7400
PIN 10 U2805C
U2867 7493
U2869 7493
U2871 7493
U2884 9322
SELECTOR
U2874B ¼7400
U2874C ¼7400
R2886 1k
Y REF
X REF
LOAD DELAY
VIDEO BLANKING
X START
Y START
V PULSE DELAYED
H PULSE DELAYED
LOAD DELAY
COMP BLANKING
TYPE | VCC +4.9V | GND
7400 | 14 | 7
7404 | 14 | 7
7420 | 14 | 7
7475 | 5 | 12
7493 | 5 | 10
74121 | 14 | 7
9322 | 16 | 8
7474 | 14 | 7
DATA TIMER BOARD A19
(SEE ◇ FOR INPUT OUTPUT DETAILS)



*See Parts List for serial number ranges.

Fig. 8-18. A20—Memory circuit board.

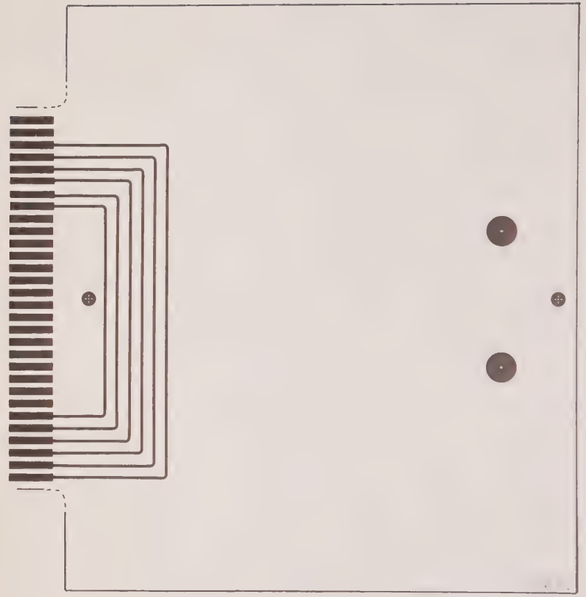
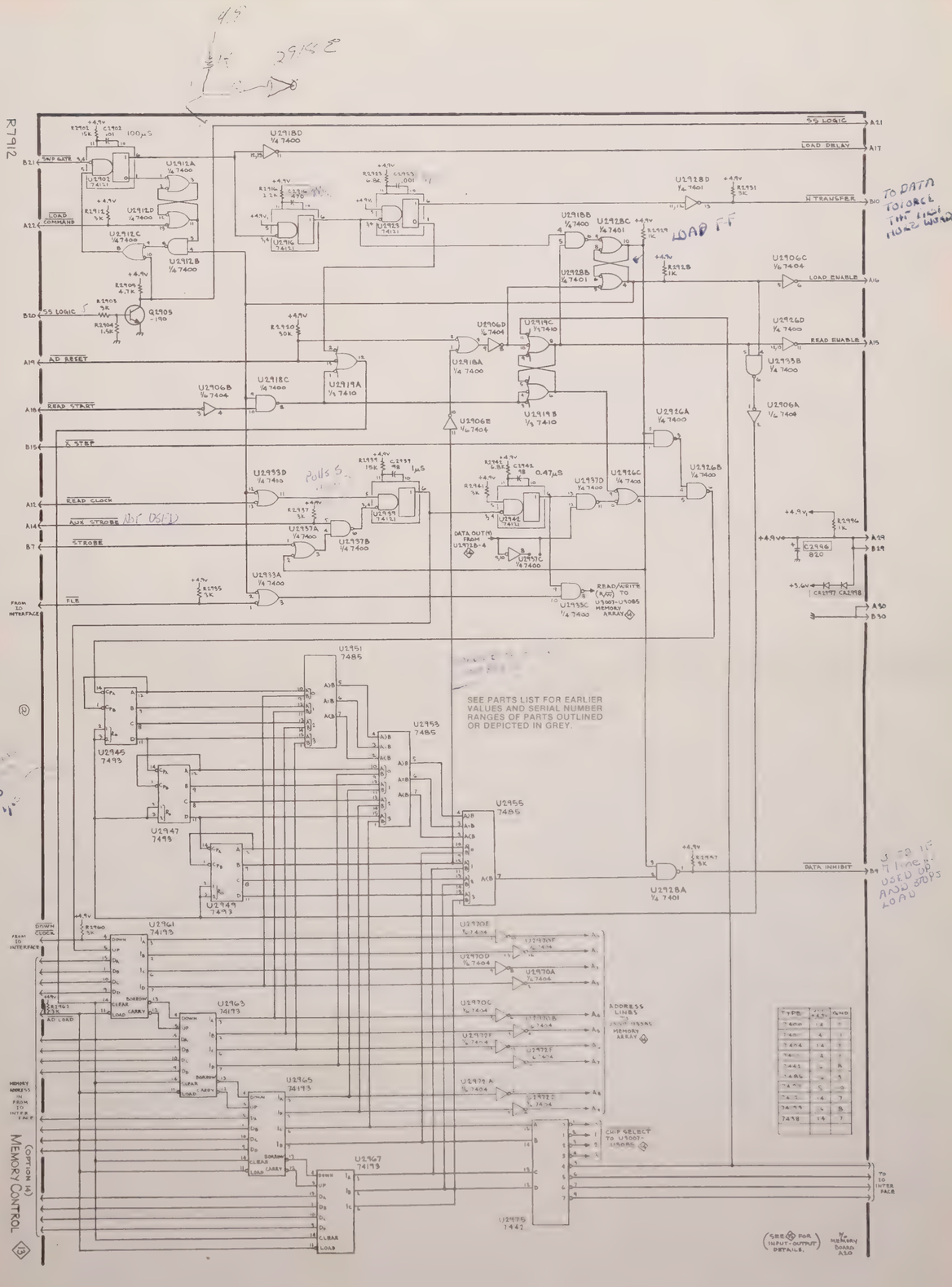


Fig. 8-18A. A32—Memory Bypass circuit board.

GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO
C2902	A2	R2905	C2	R2996	B2	U2902	B2	U2951	B4	U3013	C8	U3045	E9	U3077	C11
C2916	B3	R2912	A3	R3001	E7	U2906	C2	U2953	B4	U3015	C8	U3047	B10	U3079	D11
C2923	C3	R2916	B3	R3003	D6	U2912	B3	U2955	C4	U3017	C8	U3049	B10	U3081	D11
C2929	F5	R2920	D2	R3006	D7	U2916	B3	U2961	B5	U3019	D8	U3051	C10	U3083	E11
C2942	D5	R2923	C3	R3091	C6	U2918	D2	U2963	B5	U3021	D8	U3053	C10	U3085	E11
C2996	E5	R2928	F3	R3080	C2	U2919	D3	U2965	C5	U3023	E8	U3055	C10	U3091	C7
		R2929	E3	R3082	C2	U2923	C3	U2967	C5	U3025	E8	U3057	C10	U3093	C7
		R2931	E3	R3084	C2	U2926	E3	U2970	B6	U3027	B9	U3059	D10		
CR2997	C2	R2935	E4	R3086	C2	U2928	E3	U2972	B6	U3029	B9	U3061	D10		
CR2998	B2	R2937	D6	R3088	C2	U2933	E4	U2975	D5	U3031	C9	U3063	E10		
		R2939	F5	R3090	C2	U2937	E6	U3001	D7	U3033	C9	U3065	E10		
Q2905	C2	R2941	D6	R3092	C2	U2939	E5	U3003	E7	U3035	C9	U3067	B11		
		R2942	D5	R3094	C2	U2942	E5	U3005	E6	U3037	C9	U3069	B11		
R2902	B2	R2957	F2	R3096	B2	U2945	C4	U3007	B8	U3039	D9	U3071	C11		
R2903	C2	R2960	A3	R3098	B2	U2947	D4	U3009	B8	U3041	D9	U3073	C11		
R2904	C2	R2962	C6			U2949	E4	U3011	C8	U3043	E9	U3075	C11		


R7912
MEMORY CONTROL (OPTION W)
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SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
SS LOGIC
LOAD DELAY
N TRANSFER
LOAD ENABLE
READ ENABLE
AD RESET
READ START
R STEP
READ CLOCK
AUX STROBE
STROBE
FLB
DATA INHIBIT
DATA OUT(N) FROM U1912B-4
READ/WRITE (R/W) TO U1901-U1985 MEMORY ARRAY
ADDRESS LINES (NOW NAMED MEMORY ARRAY)
CHIP SELECT TO U1901-U1985
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FROM SD INTERFACE
DOWN CLOCK
AD LOAD
MEMORY ADDRESS IN FROM SD INTERFACE
SEE FOR INPUT-OUTPUT DETAILS.
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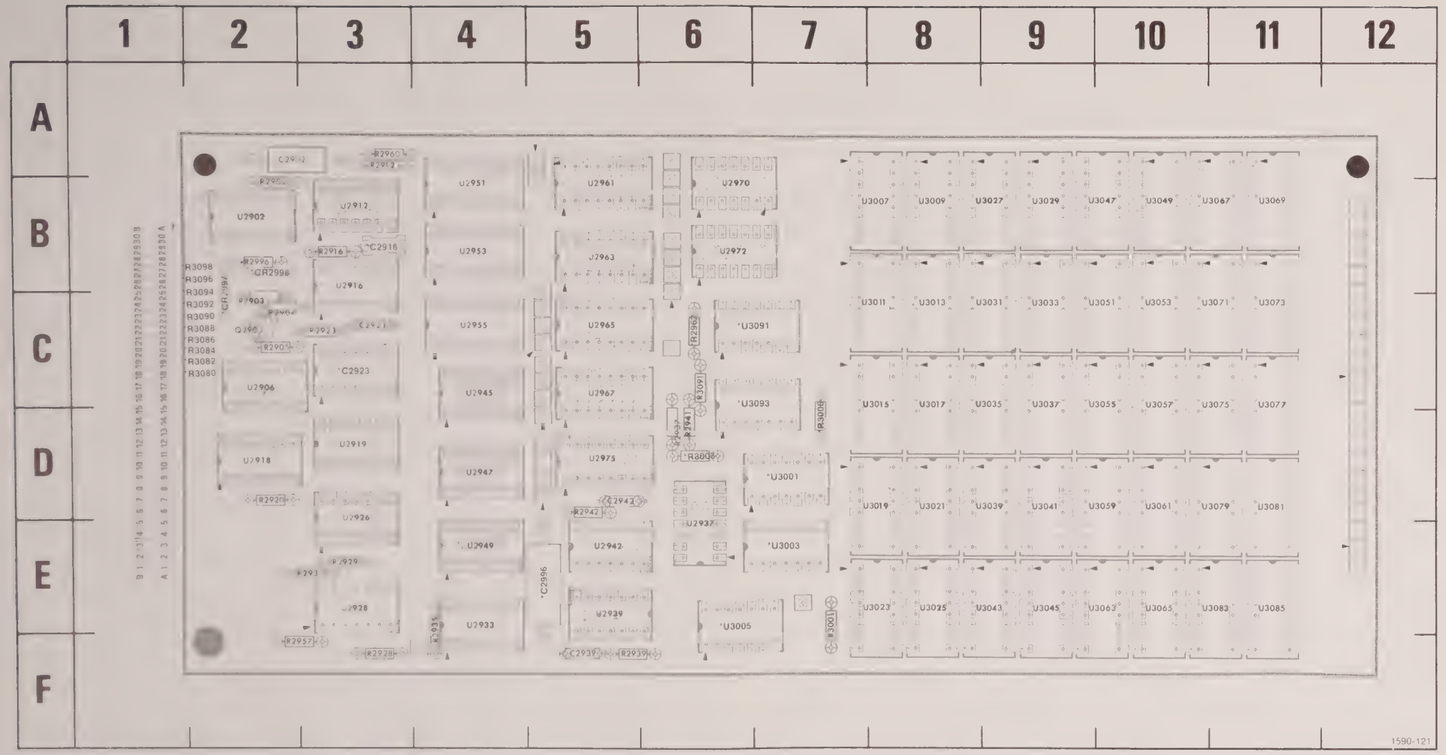

*See Parts List for serial number ranges.

Fig. 8-19. A20 Memory circuit board.

GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO
C2902	A2	R2905	C2	R2996	B2	U2902	B2	U2951	B4	U3013	C8	U3045	E9	U3077	C11
C2916	B3	R2912	A3	R3001	E7	U2906	C2	U2953	B4	U3015	C8	U3047	B10	U3079	D11
C2923	C3	R2916	B3	R3003	D6	U2912	B3	U2955	C4	U3017	C8	U3049	B10	U3081	D11
C2929	F5	R2920	D2	R3006	D7	U2916	B3	U2961	B5	U3019	C8	U3051	C10	U3083	E11
C2942	D5	R2923	C3	R3091	C6	U2918	D2	U2963	B5	U3021	D8	U3053	C10	U3085	E11
C2996	E5	R2928	F3	R3080	C2	U2919	D3	U2965	C5	U3023	E8	U3055	C10	U3091	C7
		R2929	E3	R3082	C2	U2923	C3	U2967	C5	U3025	E8	U3057	C10	U3093	C7
		R2931	E3	R3084	C2	U2926	E3	U2970	B6	U3027	B9	U3059	D10		
CR2997	C2	R2935	E4	R3086	C2	U2928	E3	U2972	B6	U3029	B9	U3061	D10		
CR2998	B2	R2937	D6	R3088	C2	U2933	E4	U2975	D5	U3031	C9	U3063	E10		
		R2939	F5	R3090	C2	U2937	E6	U3001	D7	U3033	C9	U3065	E10		
Q2905	C2	R2941	D6	R3092	C2	U2939	E5	U3003	E7	U3035	C9	U3067	B11		
		R2942	D5	R3094	C2	U2942	E5	U3005	E6	U3037	C9	U3069	B11		
R2902	B2	R2957	F2	R3096	B2	U2945	C4	U3007	B8	U3039	D9	U3071	C11		
R2903	C2	R2960	A3	R3098	B2	U2947	D4	U3009	B8	U3041	D9	U3073	C11		
R2904	C2	R2962	C6			U2949	E4	U3011	C8	U3043	E9	U3075	C11		

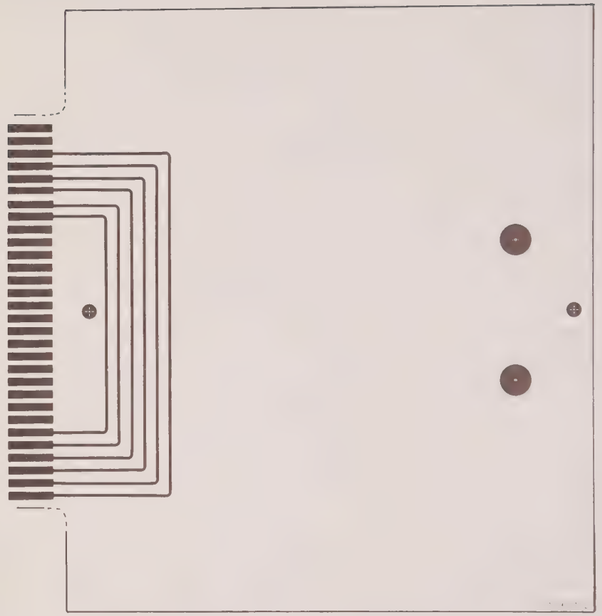

Fig. 8-19A. A32–Memory Bypass circuit board.

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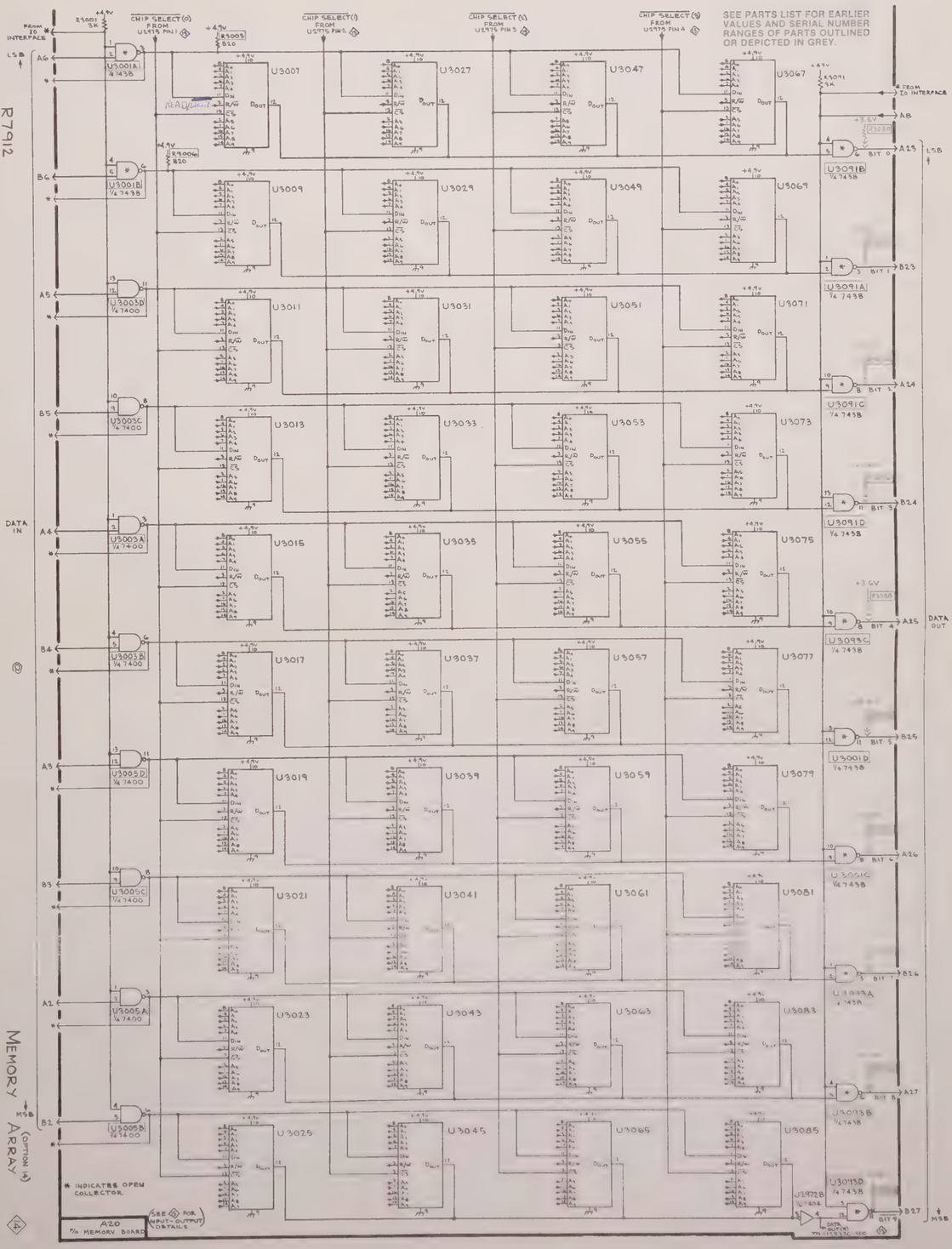
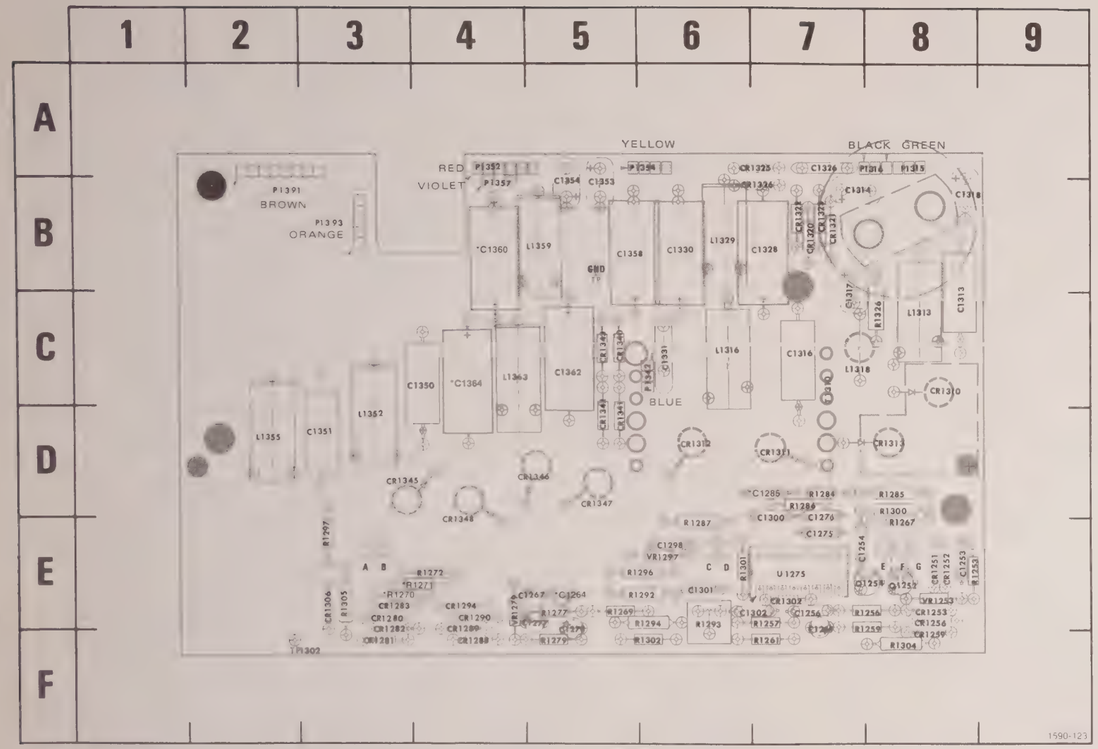
4096 - 10 bit WORDS

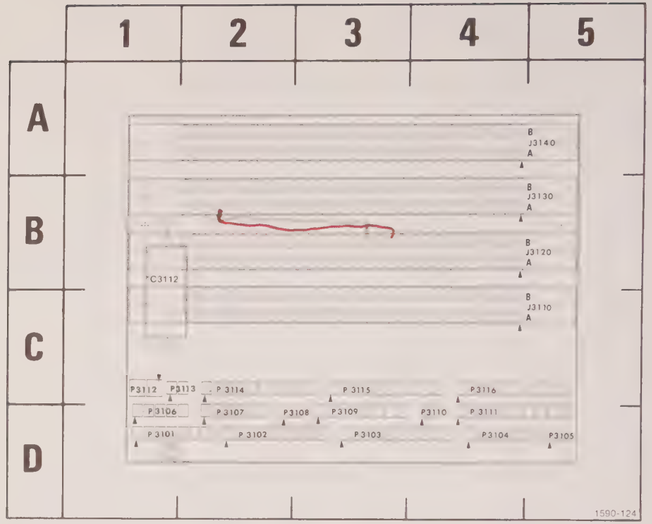




*See Parts List for serial number ranges.

Fig. 8-20. A26—Cap Rectifier circuit board.

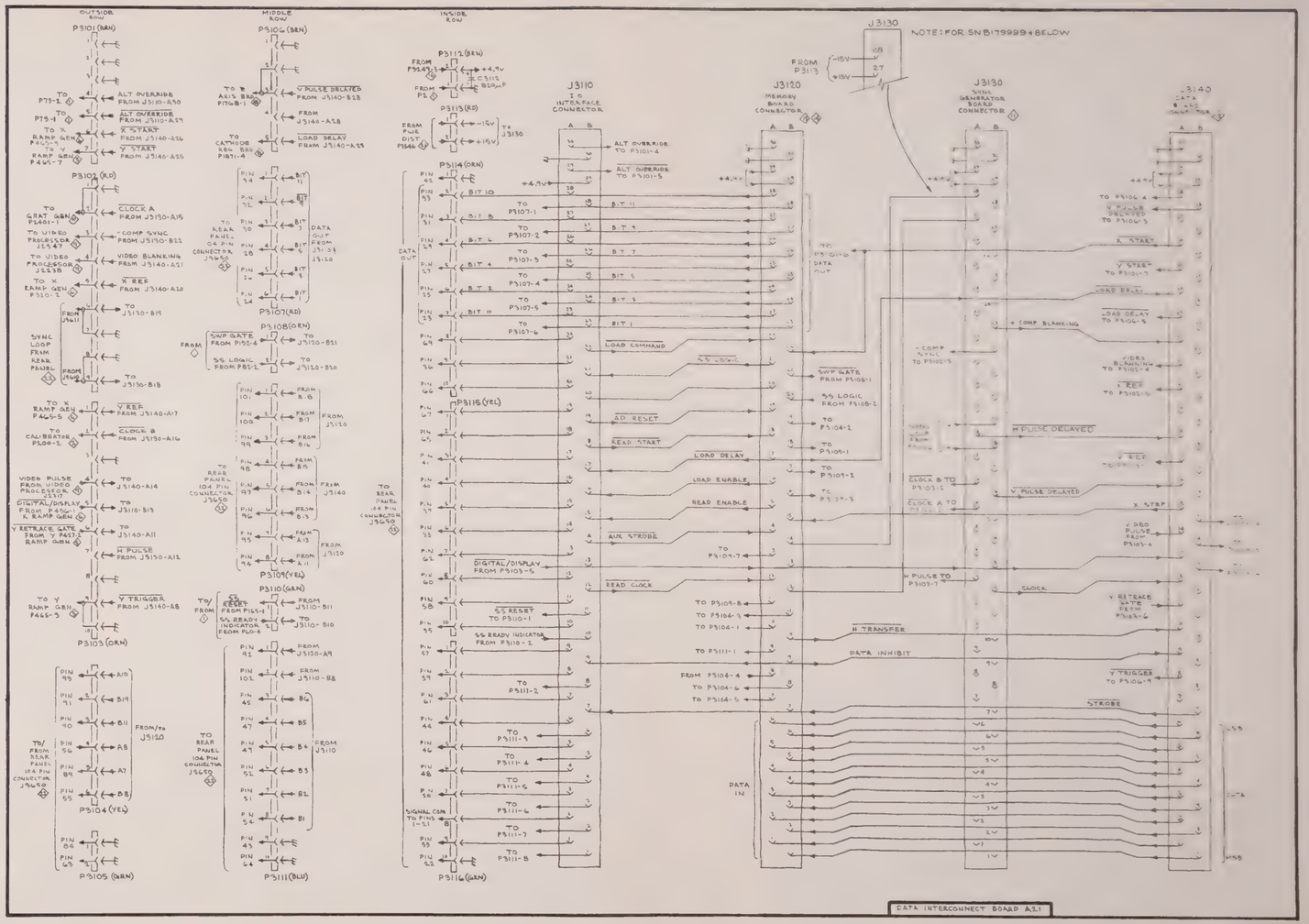
CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C1253	E8	CR1306	E3	R1269	E5
C1254	E7	CR1310	C8	R1270	E3
C1256	E7	CR1311	D7	R1271	E4
C1259	E7	CR1312	D6	R1272	E4
C1264	E5	CR1313	D8	R1277	E5
C1267	E5	CR1320	B7	R1279	F5
C1275	E7	CR1321	B7	R1284	D7
C1276	D7	CR1322	B7	R1285	D8
C1277	E5	CR1323	B8	R1286	D7
C1278	E5	CR1325	A7	R1287	E6
C1285	D7	CR1326	B7	R1292	E6
C1298	E6	CR1340	C5	R1293	E6
C1300	D7	CR1341	D5	R1294	E6
C1301	E6	CR1342	D5	R1296	E6
C1302	E7	CR1343	C5	R1297	E3
C1313	C8	CR1345	D3	R1300	D8
C1314	B7	CR1346	D5	R1301	E6
C1316	C7	CR1347	D5	R1302	F6
C1317	C7	CR1348	D4	R1304	F8
C1318	B8			R1305	E3
C1326	A7	L1313	C8	R1326	C8
C1328	B7	L1316	C6		
C1330	B6	L1318	C7	T1310	C7
C1331	C6	L1329	B6	TP1302	F3
C1350	C4	L1352	D3		
C1351	D3	L1355	D2	U1275	E7
C1353	B4	L1359	B5		
C1354	B5	L1363	C4	VR1253	E8
C1358	B5			VR1279	E4
C1360	B4	P1315	A8	VR1297	E6
C1362	C5	P1316	A8		
C1364	C4	P1342	C6		
		P1352	B4		
CR1251	E8	P1354	A6		
CR1252	E8	P1357	A4		
CR1253	E8	P1391	B2		
CR1256	E8	P1393	B3		
CR1259	F8				
CR1280	E3	Q1252	E8		
CR1281	F3	Q1254	E8		
CR1282	E3				
CR1283	E3	R1253	E8		
CR1288	F4	R1256	E8		
CR1289	E4	R1257	E7		
CR1290	E4	R1259	E8		
CR1294	E4	R1261	F7		
CR1302	E7	R1267	E8		



*See Parts List for serial number ranges.

Fig. 8-21. A21 Data Interconnect circuit board.

CKT NO	GRID LOC
C3112	B1
J3110	C5
J3120	B5
J3130	B5
J3140	A5
P3101	D1
P3102	D2
P3103	D3
P3104	D4
P3105	D5
P3106	D1
P3107	D2
P3108	D3
P3109	D3
P3110	D4
P3111	D4
P3112	C1
P3113	C2
P3114	C2
P3115	C3
P3116	C4

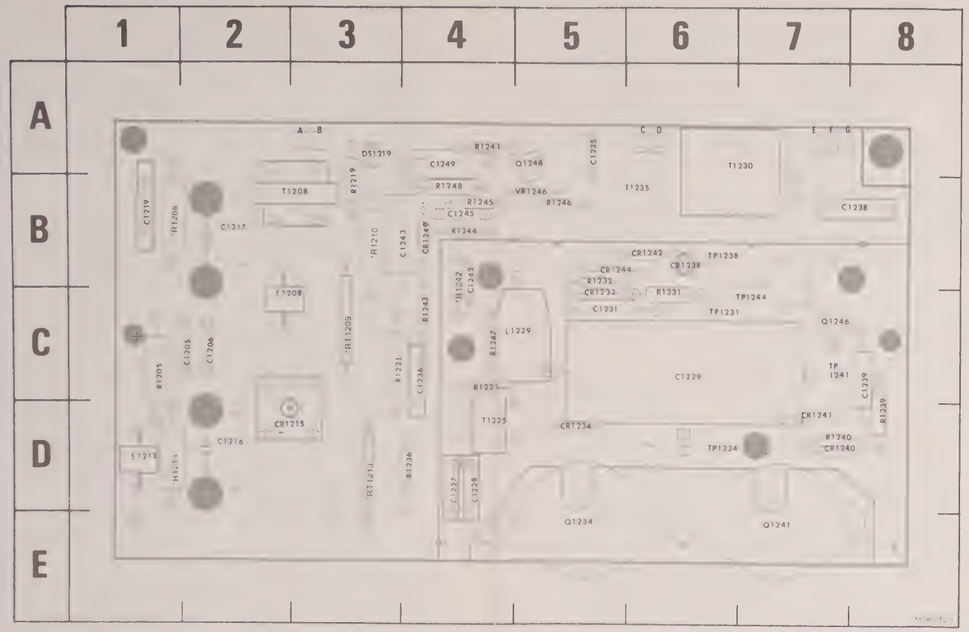


R7912

@

DATA INTERCONNECT

15



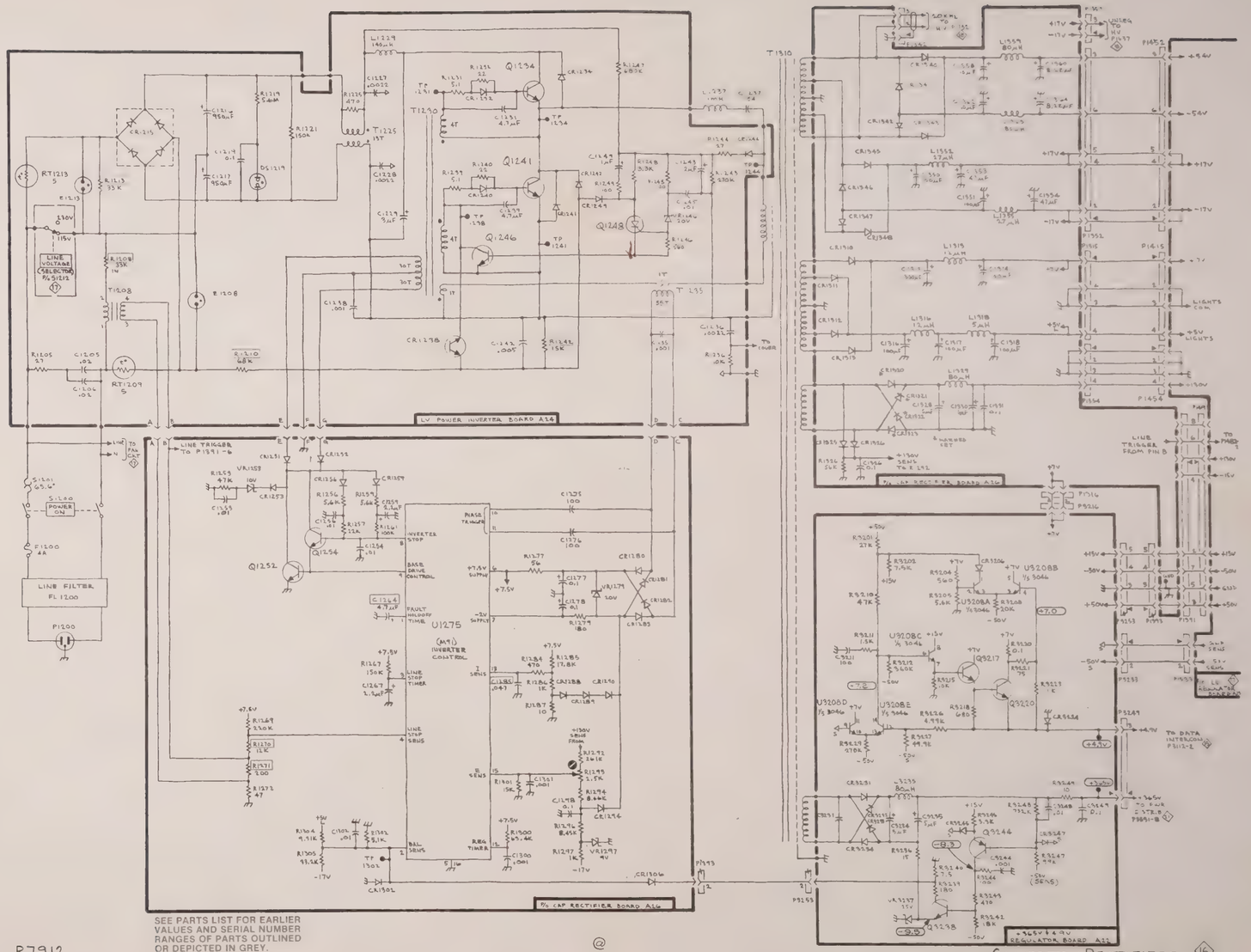
*See Parts List for serial number ranges.

Fig. 8-22. A24 Low Voltage Power Inverter circuit board.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C1205	C2	C1236	C4	E1208	C2	CR1244	B5	R1205	C1	R1239	D8	RT1209	C3	TP1231	C6
C1206	C2	C1238	B8	E1213	D1	CR1249	B4	R1208	B1	R1240	D7	RT1213	C3	TP1234	D6
C1216	D2	C1239	C8					R1210	B3	R1242	B4			TP1238	B6
C1217	B2	C1242	B4	CR1215	D2	L1229	C5	R1213	D1	R1243	C4	T1208	B3	TP1241	C7
C1219	B1	C1243	B3	CR1232	C5			R1219	B3	R1244	B4	T1230	A7	TP1244	C7
C1227	D4	C1245	B4	CR1234	D5	Q1234	E5	R1221	C3	R1246	B5	T1225	D4		
C1228	D4	C1249	A4	CR1238	B6	Q1241	E7	R1225	C4	R1245	B4	T1235	B6	VR1246	B5
C1229	C6			CR1241	D7	Q1246	C7	R1231	C6	R1247	C4				
C1231	C5	DS1219	A3	CR1240	D7	Q1248	A5	R1232	B5	R1248	B4				
C1235	A5			CR1242	B6			R1236	D4	R1249	A4				

Fig. 8-23. A22 +1365 and +4.9 Volt Regulator circuit board.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C3211	C5	L3235	A5	R3208	B5	R3240	C3
R3231	B3			R3205	B6	R3242	C4
C3234	A3	P3216	C5	R3210	C6	R3243	C4
C3235	B3	P3233	A6	R3211	C6	R3244	C4
C3244	C4	P3249	A6	R3212	B5	R3245	C4
C3248	C3	P3253	A5	R3212	B5	R3247	C4
C3249	B4	P3531	A6	R3218	D5	R3248	C3
				R3220	C5	R3249	B4
CR3205	B6	Q3217	D5	R3221	C5	R3251	B5
CR3224	D4	Q3220	D4	R3223	B5		
CR3231	A3	Q3228	C3	R3223	B5	TP49	A6
CR3232	A3	Q3244	C3	R3226	D6	TP365	A6
CR3233	B3			R3227	D6		
CR3234	B3	R3201	B6	R3229	C6	U3208	C5
CR3245	C4	R3202	B5	R3236	C2		
CR3247	C4	R3204	B5	R3239	C3	VR3237	C3


LV POWER INVERTER BOARD A24
LINE TRIGGER TO P1591-6
INVERTER STOP
BASE DRIVE CONTROL
FAULT TIMEOUT TIMER
U1275
(A9) INVERTER CONTROL
LINE STOP TIMER
LINE STOP SENS
BAL SENS
REG TIMER
PHASE TRIGGER
+7.5V SUPPLY
-5V SUPPLY
+150V SENSE FROM T1290
LINE FILTER FL1200
LINE VOLTAGE SELECTOR
POWER ON
T1290
T1225
T1208
T1295
T1310
Q1234
Q1241
Q1246
Q1248
Q1256
Q1252
TO LOWER
TO FAN CAP
P1200
P1591
P1592
P1593
P1594
P1595
P1596
P1597
P1598
P1599
P1591-6
P1591-5
P1591-7
P1591-8
P1591-9
P1591-10
P1591-11
P1591-12
P1591-13
P1591-14
P1591-15
P1591-16
P1591-17
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P1591-31
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P1591-45
P1591-46

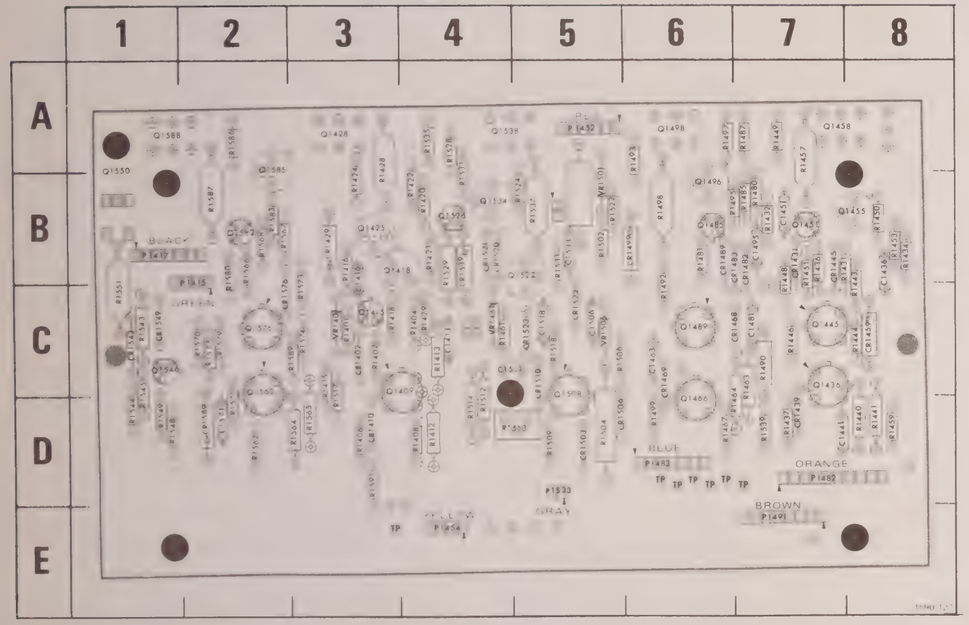
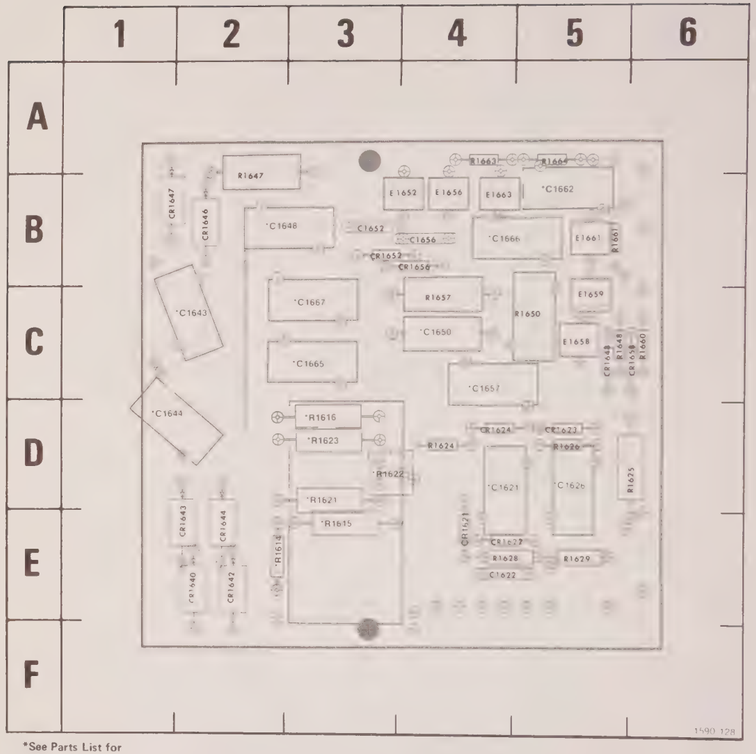


Fig. 8-24. A23—Low Voltage Regulator circuit board.

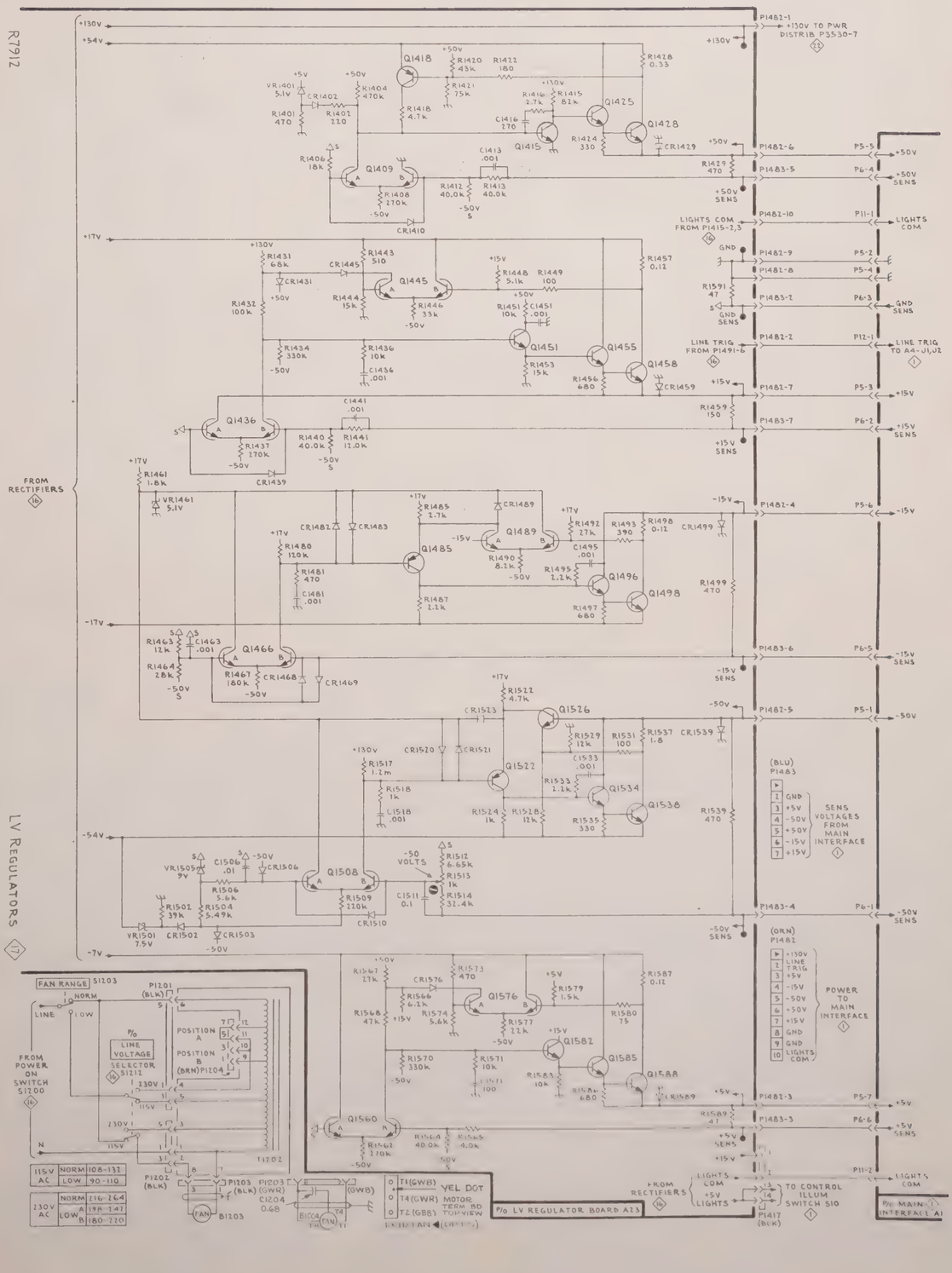
CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C1413	C4	CR1543	C1	Q1550	A1	R1450	B8	R1535	A4
C1416	B3	CR1549	C1	Q1560	C2	R1451	C7	R1537	B5
C1436	C8	CR1576	C2	Q1576	C2	R1453	B8	R1539	D7
C1441	D7	CR1589	D2	Q1582	B2	R1457	A7	R1543	C1
C1451	B7			Q1585	A2	R1459	D8	R1544	D1
C1463	C6	P1415	C2	Q1588	A1	R1461	C4	R1545	C1
C1481	C7	P1417	B1			R1463	D7	R1548	D1
C1495	B7	P1452	A5	R1401	C3	R1464	D6	R1549	D1
C1506	C5	P1454	E4	R1402	C3	R1467	D6	R1551	C1
C1511	C4	P1482	D7	R1404	C4	R1480	B7	R1562	D2
C1518	C5	P1483	D6	R1406	D3	R1481	B6	R1564	D3
C1533	B5	P1491	E7	R1408	D4	R1485	B7	R1565	D3
C1571	D2	P1533	D5	R1412	D4	R1487	A7	R1566	B2
				R1413	C4	R1490	C7	R1567	B2
CR1402	C3	Q1409	C4	R1415	C3	R1492	C6	R1568	B2
CR1410	D3	Q1415	C3	R1416	B3	R1493	A6	R1570	C2
CR1429	B3	Q1418	B3	R1418	C3	R1495	B6	R1571	D2
CR1431	B7	Q1425	B3	R1420	B4	R1497	A6	R1573	C3
CR1439	D7	Q1428	A3	R1421	B4	R1498	B6	R1574	C3
CR1445	B7	Q1436	C7	R1422	B4	R1499	D6	R1577	C2
CR1459	C8	Q1445	C7	R1424	B3	R1502	B5	R1579	C2
CR1468	C6	Q1451	B7	R1428	B3	R1504	D5	R1580	B2
CR1469	C6	Q1455	B8	R1429	C4	R1506	C5	R1583	B2
CR1482	B7	Q1458	A7	R1431	B7	R1509	D5	R1586	A2
CR1483	B6	Q1466	D6	R1432	B7	R1512	D4	R1587	B2
CR1489	B6	Q1485	B6	R1434	B8	R1513	D4	R1589	C3
CR1499	B6	Q1489	C6	R1436	B7	R1514	D4	R1591	D3
CR1503	D5	Q1496	B6	R1437	D7	R1517	C3		
CR1506	D5	Q1498	A6	R1440	D8	R1518	C5	VR1401	C3
CR1510	C5	Q1508	D5	R1441	D8	R1522	B5	VR1461	C4
CR1520	B4	Q1522	B5	R1443	C8	R1524	B5	VR1501	B5
CR1521	B4	Q1526	B4	R1444	C8	R1528	A4	VR1505	C5
CR1522	C5	Q1534	B4	R1446	C7	R1529	B4		
CR1523	C5	Q1538	A4	R1448	C7	R1531	B4		
CR1539	B4	Q1545	C1	R1449	A7	R1533	B5		

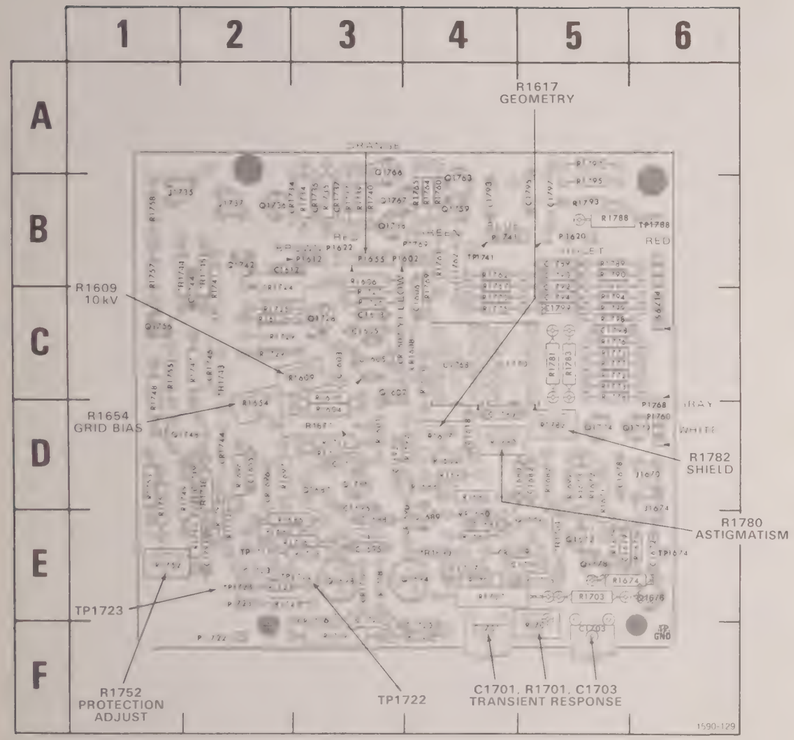


*See Parts List for serial number ranges.

Fig. 8-25. A27—High Voltage Multiplier circuit board (Potted).

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C1621	D4	CR1621	E4	E1652	B3	R1625	D6
C1622	E4	CR1622	E4	E1656	B4	R1626	D5
C1626	D5	CR1623	D5	E1658	C5	R1628	E4
C1643	C2	CR1624	D4	E1659	C5	R1629	E5
C1644	D1	CR1640	E2	E1661	B5	R1647	B2
C1648	B2	CR1642	E2	E1663	B4	R1648	C5
C1650	C4	CR1643	E2			R1650	C5
C1652	B3	CR1644	E2	R1614	E2	R1657	C4
C1656	B4	CR1646	B2	R1615	E3	R1660	C6
C1657	C4	CR1647	B1	R1616	D3	R1661	B5
C1662	B5	CR1648	C5	R1621	D3	R1663	A4
C1665	C3	CR1652	B3	R1622	D3	R1664	A5
C1666	B4	CR1656	B4	R1623	D3		
C1667	C3	CR1658	C6	R1624	D4		


R7912
LV REGULATORS
17
FROM RECTIFIERS
16
+130V TO PWR DISTRIB P3530-7
22
LIGHTS COM FROM P1415-2,3
LINE TRIG FROM P1491-6
LINE TRIG TO A4-J1,J2
1
(BLU) P1483
SENS VOLTAGES FROM MAIN INTERFACE
(ORN) P1482
POWER TO MAIN INTERFACE
TO CONTROL ILLUM SWITCH S10
P/O LV REGULATOR BOARD A23
P/O MAIN INTERFACE A1
FAN RANGE S1203
FROM POWER ON SWITCH S1200
P/O LINE VOLTAGE SELECTOR S1212
POSITION A
POSITION B
115V AC NORM 108-132 LOW 90-110
230V AC NORM 216-264 LOW A 198-247 B 180-220
T1 (GWB) T4 (GWR) T2 (GBB)
VEL DOT MOTOR TERM BD TOP VIEW
FAN



*See Parts List for serial number ranges.

Fig. 8-26. A28 Z-Axis circuit board.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C1603	C3	C1780	D4	P1602	B4	Q1763	B4	R1693	D4	R1744	B1	R1782	D5
C1605	C3	C1789	B5	P1612	B3	Q1766	A3	R1696	D2	R1745	B2	R1783	C5
C1606	C4	C1790	B5	P1620	B5	Q1767	B3	R1697	D2	R1746	D2	R1788	B5
C1612	B2	C1791	E2	P1622	B3	Q1774	D5	R1699	D5	R1747	C2	R1789	B5
C1613	C3	C1792	B5	P1655	B3	Q1779	D6	R1701	F5	R1748	C1	R1790	B5
C1618	D4	C1793	B4	P1722	F2			R1703	E5	R1749	D2	R1791	E2
C1655	D2	C1794	C5	P1723	E2	R1601	D3	R1704	E5	R1750	E2	R1793	B5
C1672	E6	C1795	B5	P1741	B4	R1602	D4	R1705	E4	R1751	D1	R1794	C5
C1678	D5	C1797	B5	P1760	D6	R1604	D3	R1707	E4	R1752	E1	R1795	B5
C1679	E5	C1798	C5	P1768	D6	R1606	B3	R1711	D3	R1753	D1	R1799	A5
C1680	D5	C1799	C5	P1769	B4	R1609	C3	R1713	E3	R1654	D2	R1798	C5
C1682	D5			P1795	C6	R1610	C3	R1715	D3	R1755	C1	R1799	C5
C1683	E4	CR1607	C3			R1611	C2	R1716	E2	R1757	B1		
C1688	E3	CR1608	C4	Q1602	C3	R1613	C4	R1718	E3	R1758	B1	TP1674	E6
C1692	D3	CR1690	E4	Q1672	E5	R1617	D4	R1719	F3	R1760	B4	TP1711	E2
C1695	E3	CR1696	D2	Q1676	E6	R1617	D5	R1720	F4	R1761	B4	TP1722	E2
C1696	D3	CR1709	E4	Q1678	E5	R1672	D5	R1721	E2	R1762	B4	TP1723	E2
C1700	E5	CR1716	E3	Q1682	E5	R1673	D5	R1722	E2	R1764	B4	TP1741	B4
C1701	F4	CR1717	E3	Q1687	D3	R1674	E5	R1723	E2	R1765	B4	TP1788	B6
C1703	F5	CR1724	B2	Q1689	E4	R1675	E6	R1725	C2	R1767	B4		
C1705	E5	CR1729	C2	Q1694	E4	R1677	D3	R1726	C3	R1769	B4	U1605	C3
C1707	E4	CR1734	B2	Q1698	E3	R1678	E5	R1727	C3	R1770	C4	U1768	C4
C1711	D3	CR1735	B3	Q1711	D3	R1680	D4	R1729	C2	R1771	C5	U1770	C4
C1714	E3	CR1737	B3	Q1728	C3	R1682	D5	R1734	B3	R1772	C5		
C1720	F4	CR1744	D2	Q1736	B2	R1683	E4	R1735	B3	R1773	C5	VR1680	E4
C1721	E3	CR1745	C2	Q1738	B3	R1685	E2	R1737	B3	R1775	C4		
C1723	E2			Q1742	B2	R1686	E2	R1739	B3	R1776	C5		
C1744	C2	J1735	B1	Q1748	D2	R1688	D4	R1740	B3	R1777	C5		
C1749	D2	J1737	B2	Q1756	C1	R1690	E4	R1741	B2	R1778	C5		
C1762	B4	J1670	D6	Q1759	B4	R1692	D4	R1743	C2	R1780	D4		
		J1674	E6							R1781	C5		

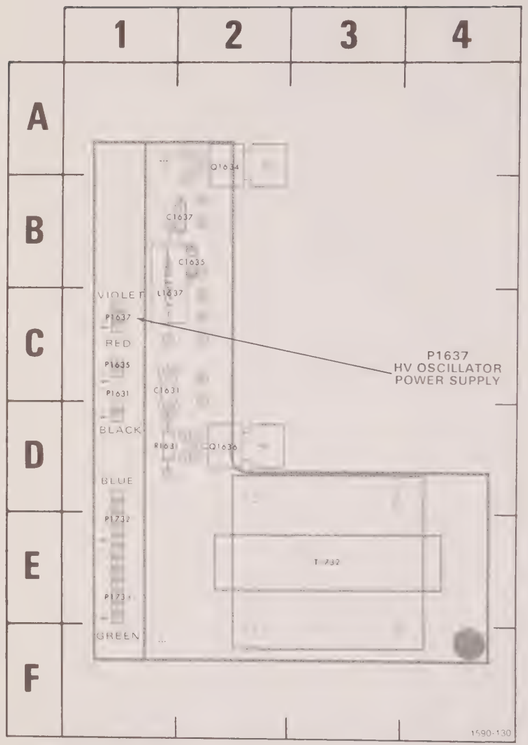
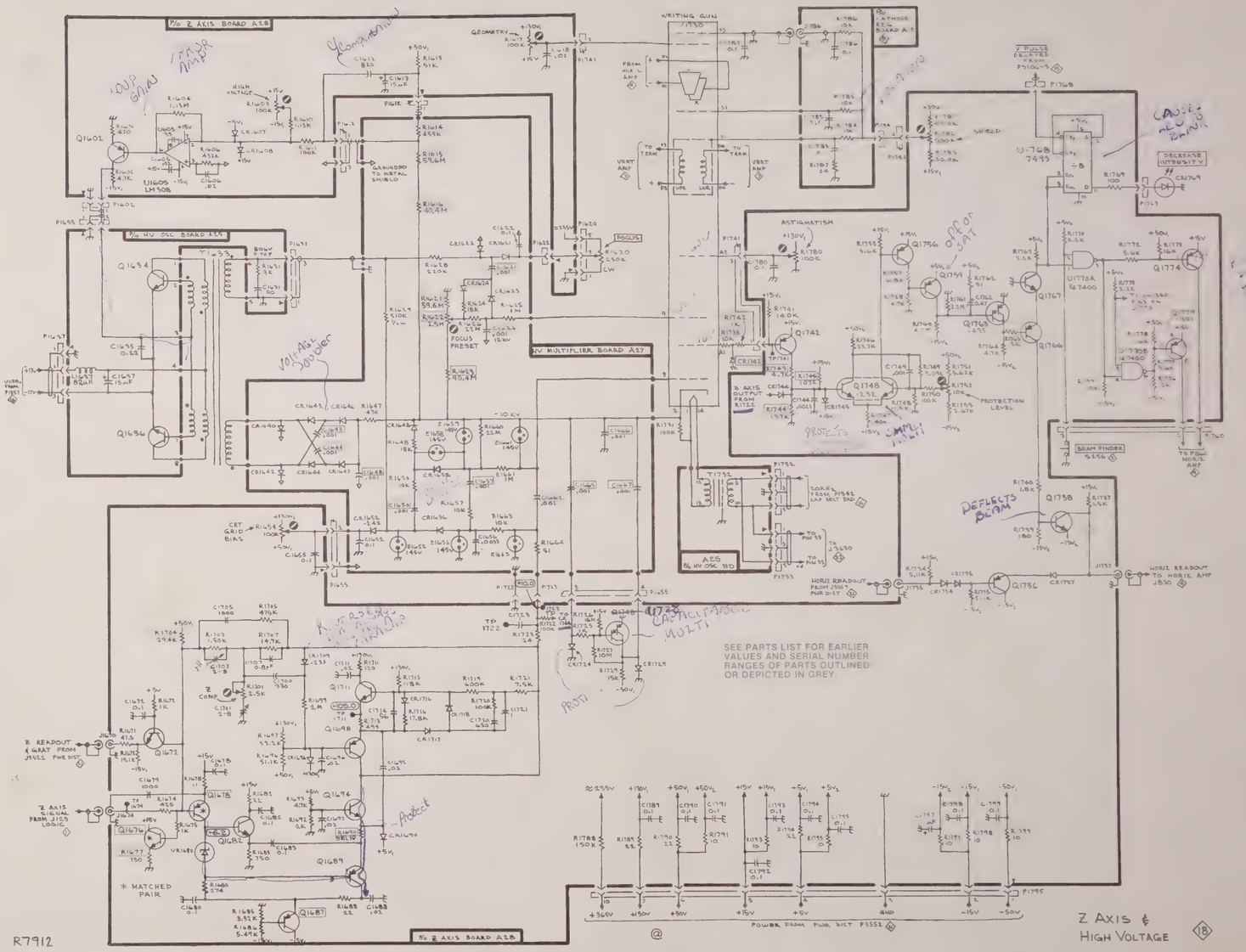
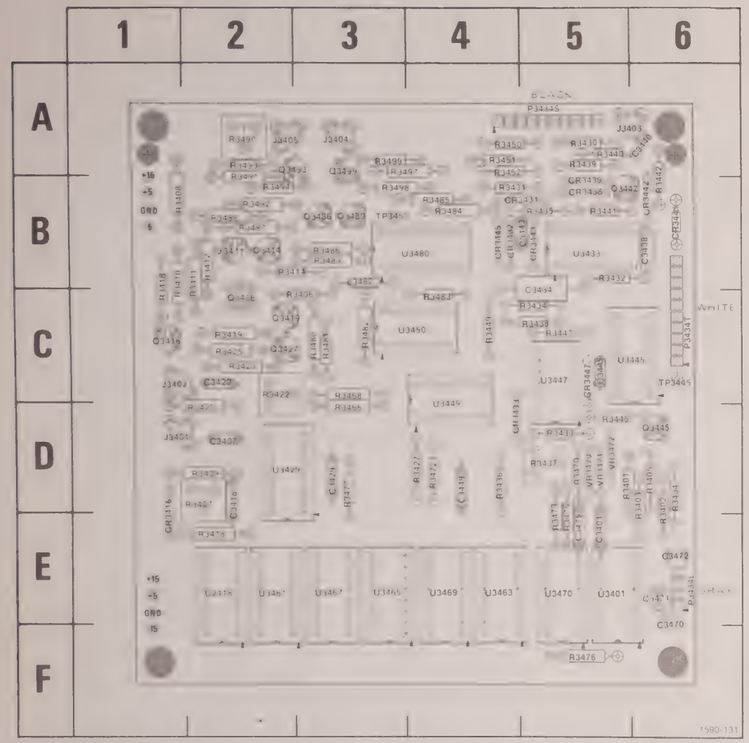


Fig. 8-27. A25 High Voltage Oscillator circuit board.

CKT NO	GRID LOC
C1631	C1
C1635	B2
C1637	B2
L1637	C1
P1631	C1
P1732	E1
P1733	E1
P1635	C1
P1637	C1
Q1634	A2
Q1636	D2
R1631	D1
T1732	E3


P/O Z AXIS BOARD A2B
P/O HV OSC BOARD A25
3V MULTIPLIER BOARD A27
P/O Z AXIS BOARD A2B
WRITING GUN
ASTIGMATISM
GEOMETRY
FOCUS
FOCUS PRESET
HIGH VOLTAGE
CRT GRID BIAS
BEAM FINDER
PROTECTION LEVEL
DEFLECTS BEAM
DECREASE INTENSITY
HORIZ READOUT TO HORIZ AMP
R READOUT & GRAT FROM J522 PWR DIST
Z AXIS SIGNAL FROM J125 LOGIC
* MATCHED PAIR
POWER FROM PWR DIST P3552
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
R7912
Z AXIS & HIGH VOLTAGE
18



*See Parts List for serial number ranges.

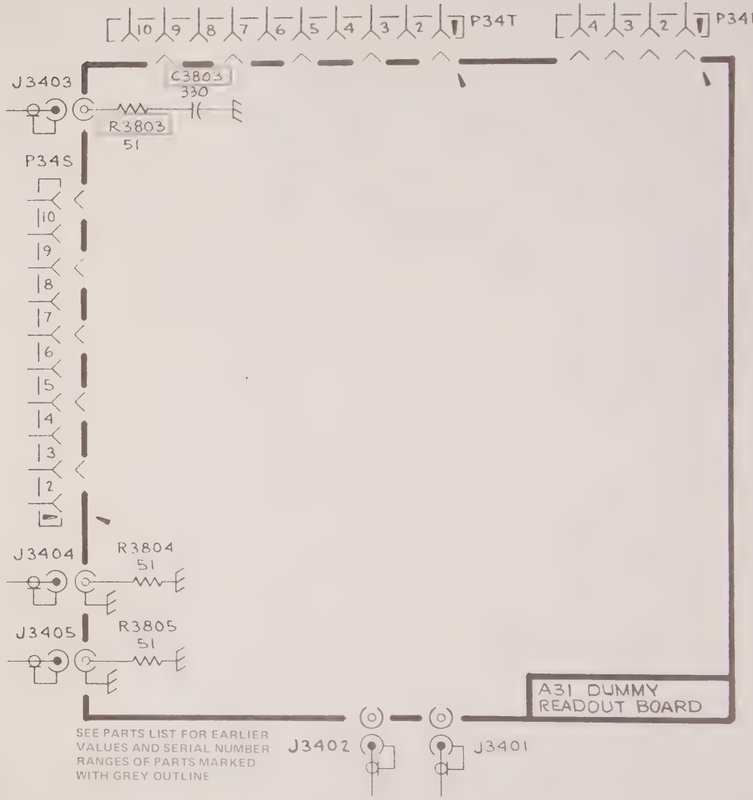
Fig 8 28 A29 Readout circuit board.

On back of board:
R3474
R3478
R3479
*R3803

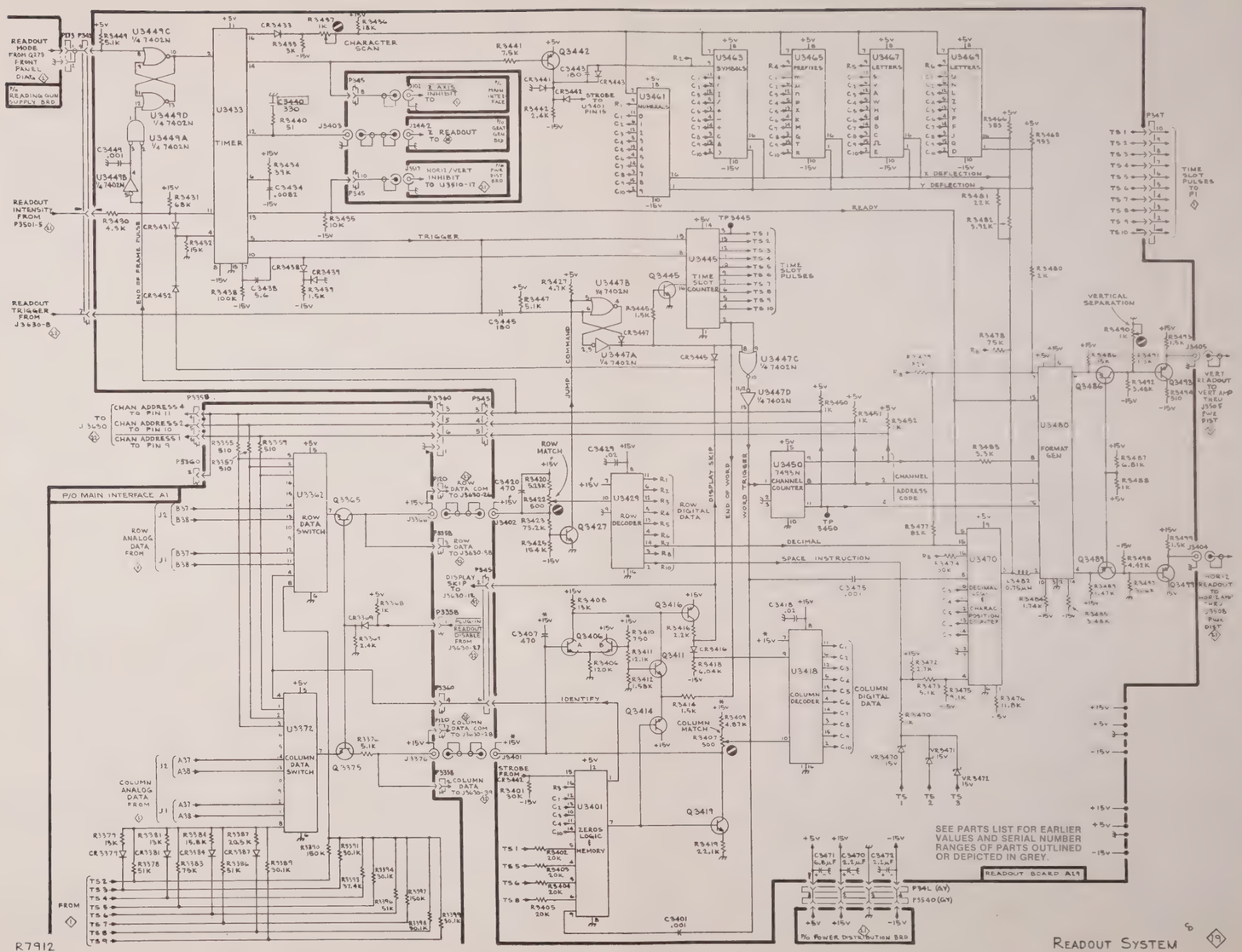
CKT NO	GRID LOC
C3401	E5
C3407	D2
C3418	D2
C3420	C2
C3429	D3
C3434	C5
C3438	B6
C3440	A6
C3443	B5
C3445	C5
C3449	D4
C3470	F6
C3471	E6
C3472	E6
C3475	E5
CR3416	E1
CR3431	B5
CR3432	B4
CR3433	D4
CR3438	B5
CR3439	B5
CR3441	B6
CR3442	B6
CR3443	B5
CR3445	B4
CR3447	C5
J3401	D1
J3402	C1
J3403	A5
J3404	A3
J3405	A2
L3482	B3
P3434L	E6
P3434T	C6
P3434S	A5
Q3406	C2
Q3411	B2
Q3414	B2
Q3416	C1
Q3419	C2
Q3427	C2
Q3442	B5
Q3445	D6
Q3486	B3
Q3489	B3
Q3493	A3
Q3499	A3
R3401	D5
R3402	E6
R3403	E6
R3404	D6
R3405	D6
R3406	C3
R3407	D2
R3408	B1

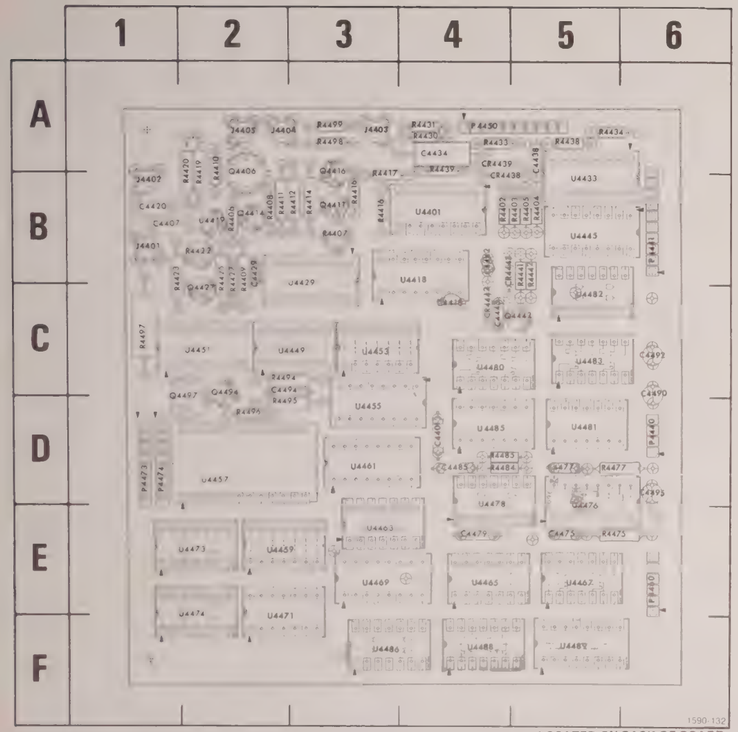
CKT NO	GRID LOC
R3409	D2
R3410	C1
R3411	C2
R3412	A2
R3414	B2
R3416	C1
R3418	E2
R3419	C2
R3420	D2
R3422	C2
R3423	C2
R3425	C2
R3427	D4
R3430	A5
R3431	B4
R3432	B5
R3433	D5
R3434	C5
R3435	B5
R3436	D4
R3437	D5
R3438	C5
R3439	A5
R3440	A5
R3441	B5
R3442	B6
R3445	D5
R3447	C5
R3449	C4
R3450	A4
R3451	A4
R3452	A4
R3466	D3
R3468	C3
R3470	D5
R3472	D4
R3473	E5
R3475	E5
R3476	F5
R3477	D3
R3480	C3
R3481	C3
R3482	C3
R3483	C4
R3484	B4
R3485	B4
R3486	B3
R3487	B2
R3488	B2
R3489	B3
R3490	A2
R3491	A2
R3492	A2
R3493	A2
R3494	A2
R3497	A3
R3498	B3
R3499	A3
TP50	B3
TP45	C6

CKT NO	GRID LOC
U3401	E5
U3418	E2
U3429	D2
U3433	B5
U3445	C5
U3447	C5
U3449	D4
U3450	C4
U3461	E2
U3463	E4
U3465	E3
U3467	E3
U3469	E4
U3470	E5
U3480	B4
VR3470	D5
VR3471	D5
VR3472	D5



SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH GREY OUTLINE


READOUT MODE FROM Q379 FRONT PANEL DIAG
READOUT INTENSITY FROM P3501-5
READOUT TRIGGER FROM J3630-8
U3449C
U3449D
U3449A
U3449B
U3433
TIMER
CHARACTER SCAN
R3441 7.5K
Q3442
STROBE TO U3401 PIN 15
U3461 NUMERALS
U3463 SYMBOLS
U3465 PREFIXES
U3467 LETTERS
U3469 LETTERS
X DEFLECTION
Y DEFLECTION
TIME SLOT PULSES TO P1
READY
TRIGGER
TIME SLOT COUNTER
U3445
TP3445
U3447A
U3447B
U3447C
U3447D
JUMP COMMAND
VERTICAL SEPARATION
VERT READOUT TO VERT AMP THRU J3506 P/W2 PWR DIST
HORIZ READOUT TO HORIZ AMP THRU J3508 PWR DIST
U3480 FORMAT GEN
U3450 CHANNEL COUNTER
CHANNEL ADDRESS CODE
DECIMAL
SPACE INSTRUCTION
U3470 CHARAC POSITION COUNTER
P/O MAIN INTERFACE A1
ROW ANALOG DATA FROM
ROW DATA SWITCH
U3362
ROW DIGITAL DATA
ROW DECODER
U3429
ROW MATCH
DISPLAY SKIP
END OF WORD
WORD TRIGGER
COLUMN ANALOG DATA FROM
COLUMN DATA SWITCH
U3372
COLUMN DIGITAL DATA
COLUMN DECODER
U3418
COLUMN MATCH
IDENTIFY
STROBE FROM CR3441
U3401 ZEROS LOGIC MEMORY
PROM
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
READOUT BOARD A19
P/O POWER DISTRIBUTION BRD
R7912
READOUT SYSTEM
19

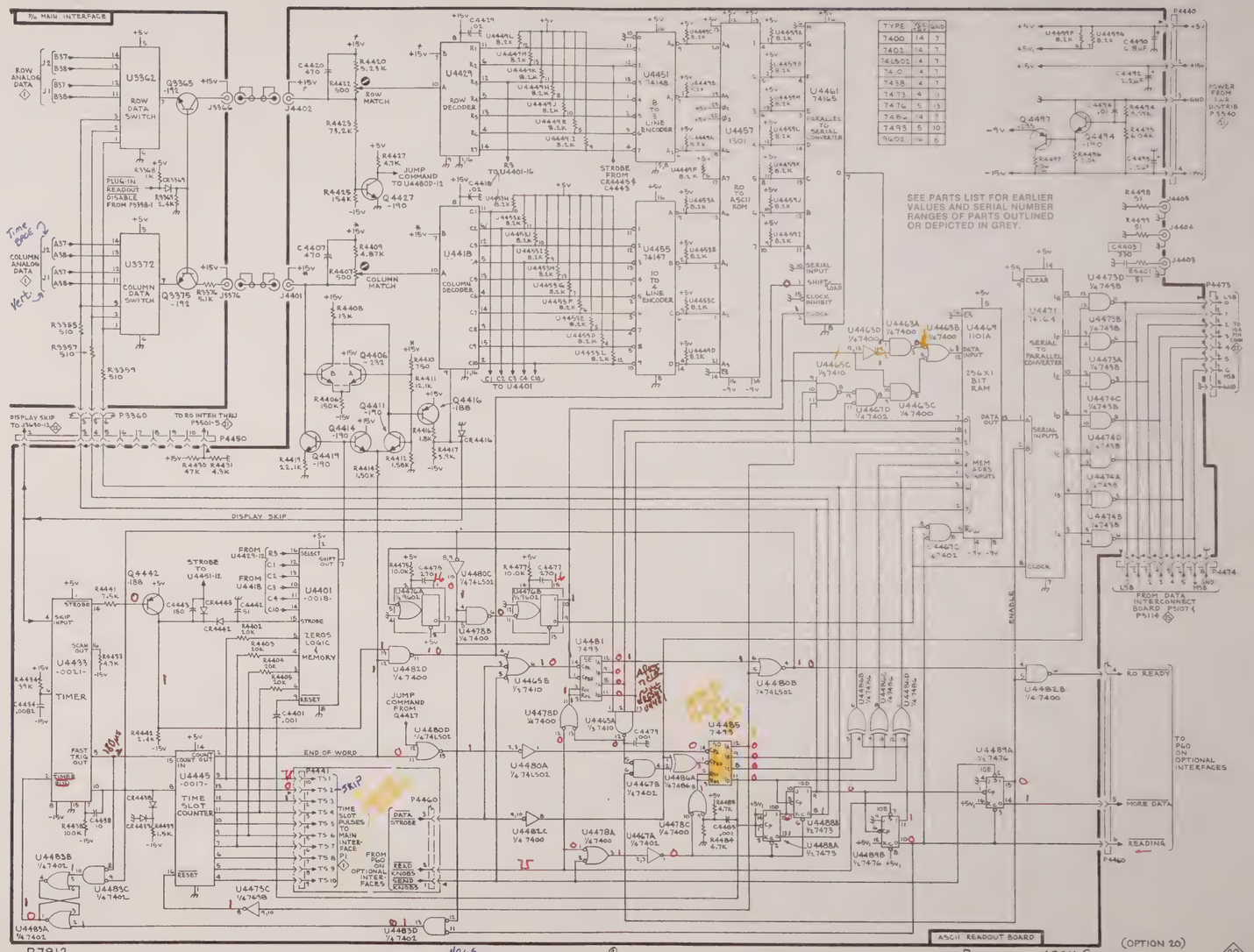


LOCATED ON BACK OF BOARD:
*R4401
*C4403

Fig. 8-29. A36 Readout to ASCII circuit board.

CKT NO	GRID LOC	CKT NO	GRID LOC
C4401	D4	R4422	B2
C4407	B1	R4423	B1
C4418	C4	R4425	B2
C4420	B1	R4427	B2
C2249	B2	R4430	A4
C4434	A4	R4431	A4
C4438	A5	R4433	A4
C4442	B4	R4434	A5
C4443	C4	R4438	A5
C4475	E5	R4439	A4
C4477	D5	R4475	E5
C4479	E4	R4477	D5
C4485	D4	R4484	D4
C4490	C6	R4485	D4
C4492	C6	R4494	C2
C4494	C2	R4495	D2
C4495	D6	R4496	D2
		R4497	C1
CR4438	A4	R4498	A3
CR4442	C4	R4499	A3
CR4439	A4		
CR4443	B4	U4401	B4
		U4418	B4
J4401	B1	U4419	B2
J4402	B1	U4429	B3
J4403	A3	U4433	B5
J4404		U4445	B5
J4405	A2	U4449	C2
		U4551	C2
P4440	D6	U4453	C3
P4441	B6	U4455	D3
P4450	A4	U4457	D2
P4460	E6	U4459	E2
P4473	D1	U4461	D3
P4474	D1	U4463	E3
		U4465	E4
Q4406	A2	U4467	E5
Q4411	B3	U4469	E3
Q4414	B2	U4471	F2
Q4416	A3	U4473	E2
Q4427	C2	U4474	F2
Q4442	C5	U4476	E5
Q4494	C2	U4478	E4
Q4497	C2	U4480	C4
		U4481	D5
R4402	B4	U4482	C5
R4403	B5	U4483	C5
R4404	B5	U4485	D4
R4405	B5	U4486	F3
R4406	B2	U4488	F4
R4407	B3	U4489	F5
R4408	B2		
R4409	B2		
R4410	A2		
R4411	B2		
R4412	B3		
R4414	B3		
R4416	B3		
R4417	A3		
R4419	A2		
R4420	A2		

Pin 9 U4488	Pin 8 U4488	Pin 13 U4488A	Plug in Chanel	OCTAL for Chanel ADDRES
0	1	1	Vert 1	100-176
0	1	0	Vert 2	00-76
1	0	1	Horz 1	300-376
1	0	0	Horz 2 alyo	200-276

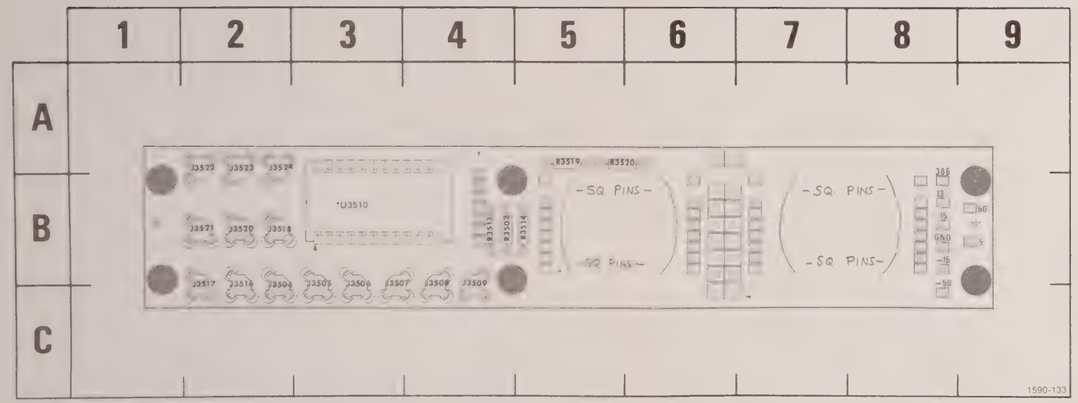


R7912

(OPTION 20)

READOUT TO ASCII CONVERTER

20



*See Parts List for serial number ranges.

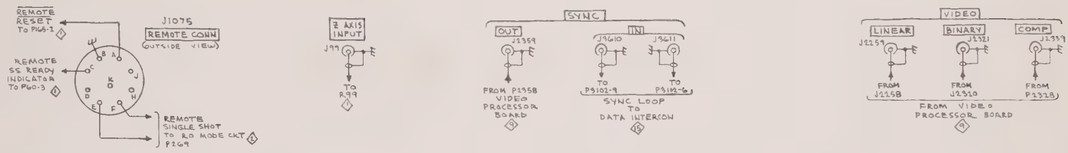
Fig. 8-30. A30—Power Distribution circuit board.

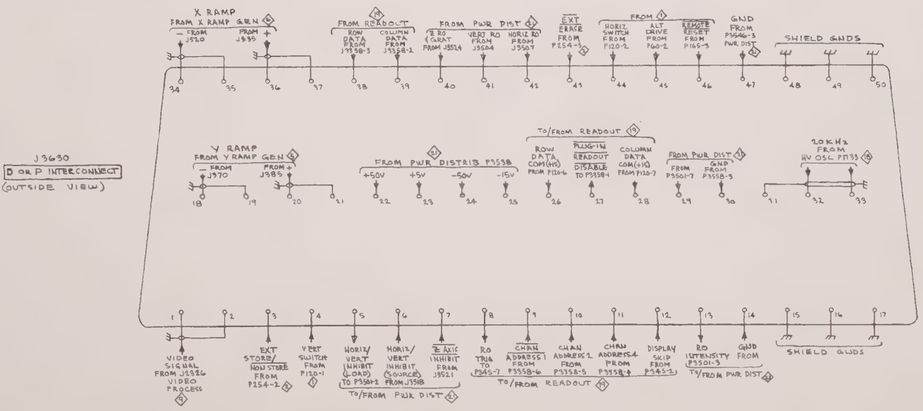
CKT NO	GRID LOC
J3504	B2
J3505	B3
J3506	B3
J3507	B3
J3508	B4
J3509	B4
J3516	B2
J3517	B2
J3518	B2
J3520	B2
J3521	B2
J3522	A2
J3523	A2
J3524	A2
R3502	B4
R3513	B4
R3514	B5
R3519	A5
R3520	A5
U3510	B3

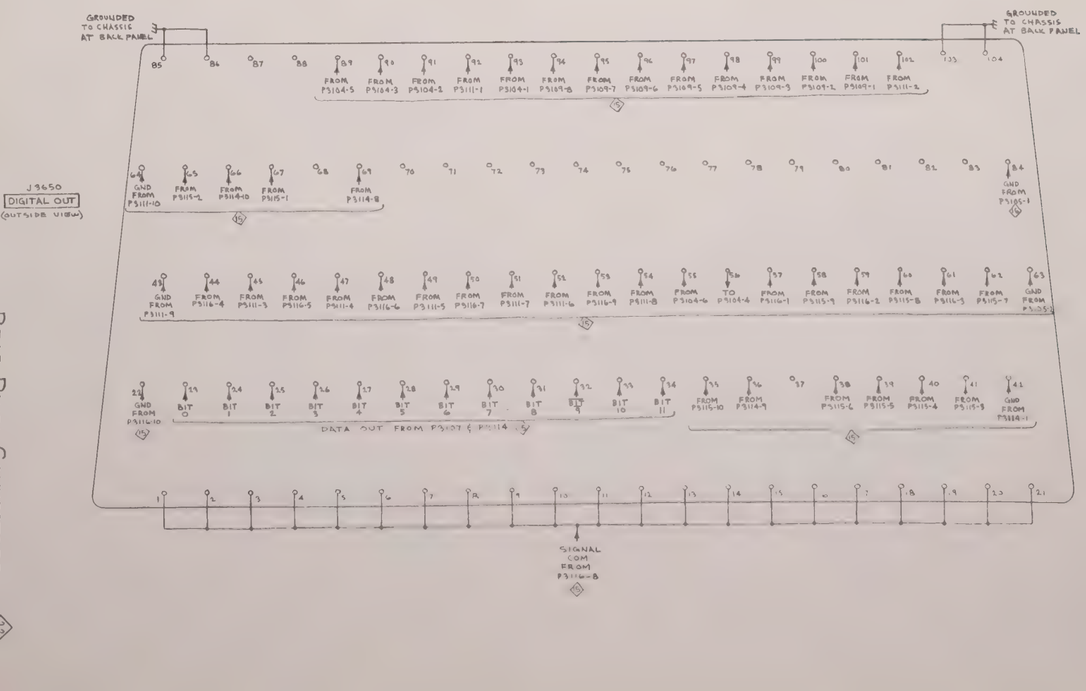
R7912

Power Distribution 21

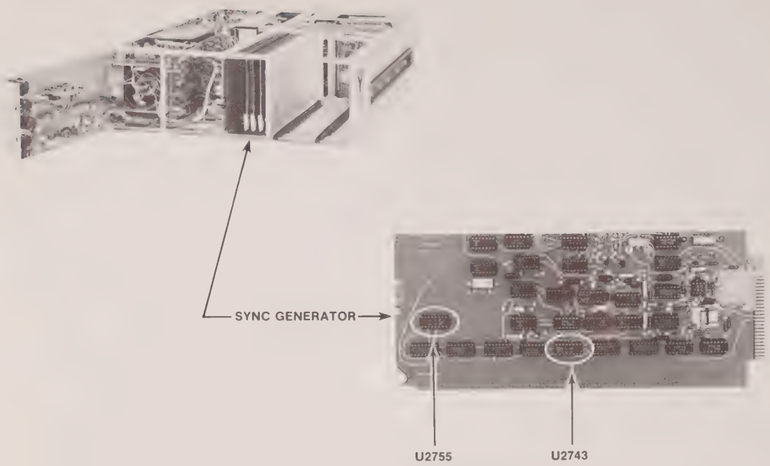
R7912

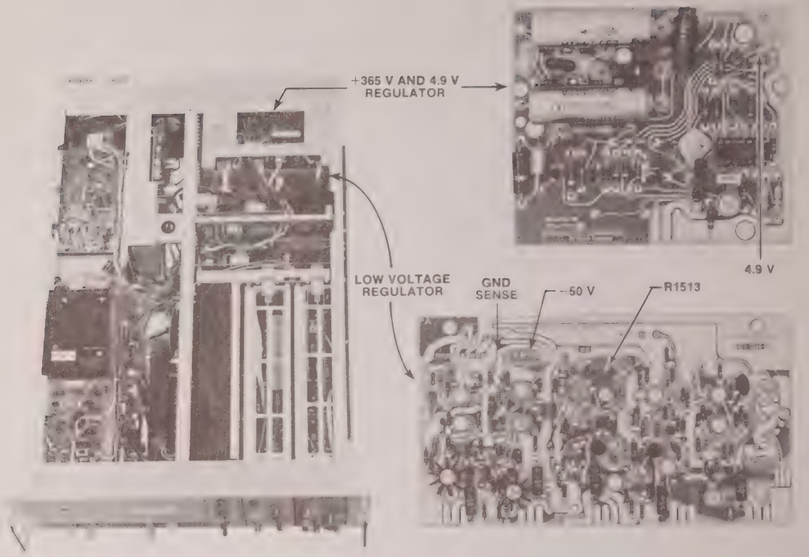






REAR PANEL CONNECTORS





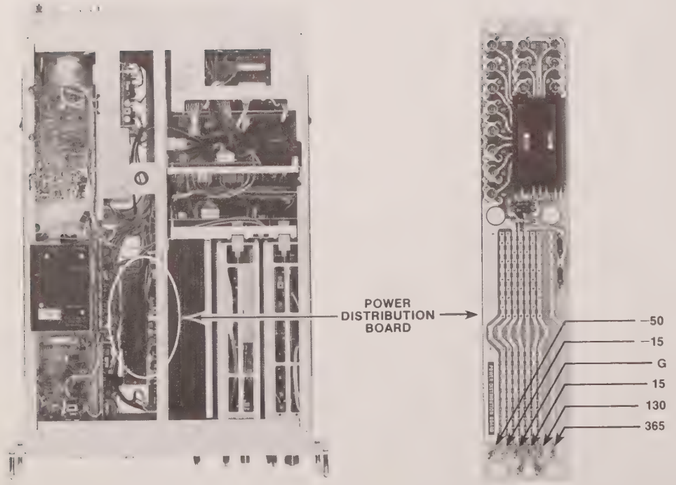


Fig. 8-31. STEPS 1-3. 1590-76

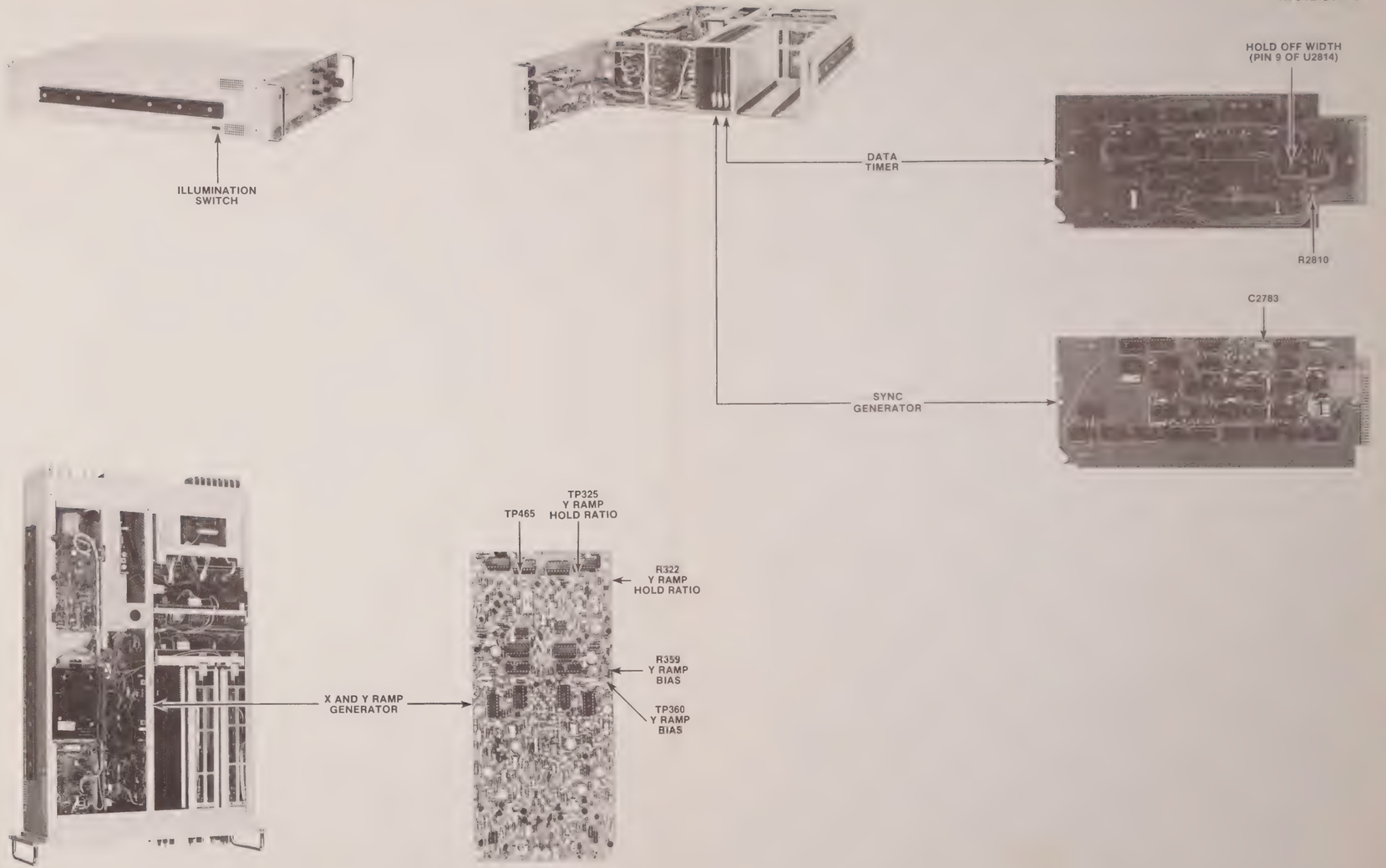


Fig. 8-32. STEPS 4-8. 1590-77

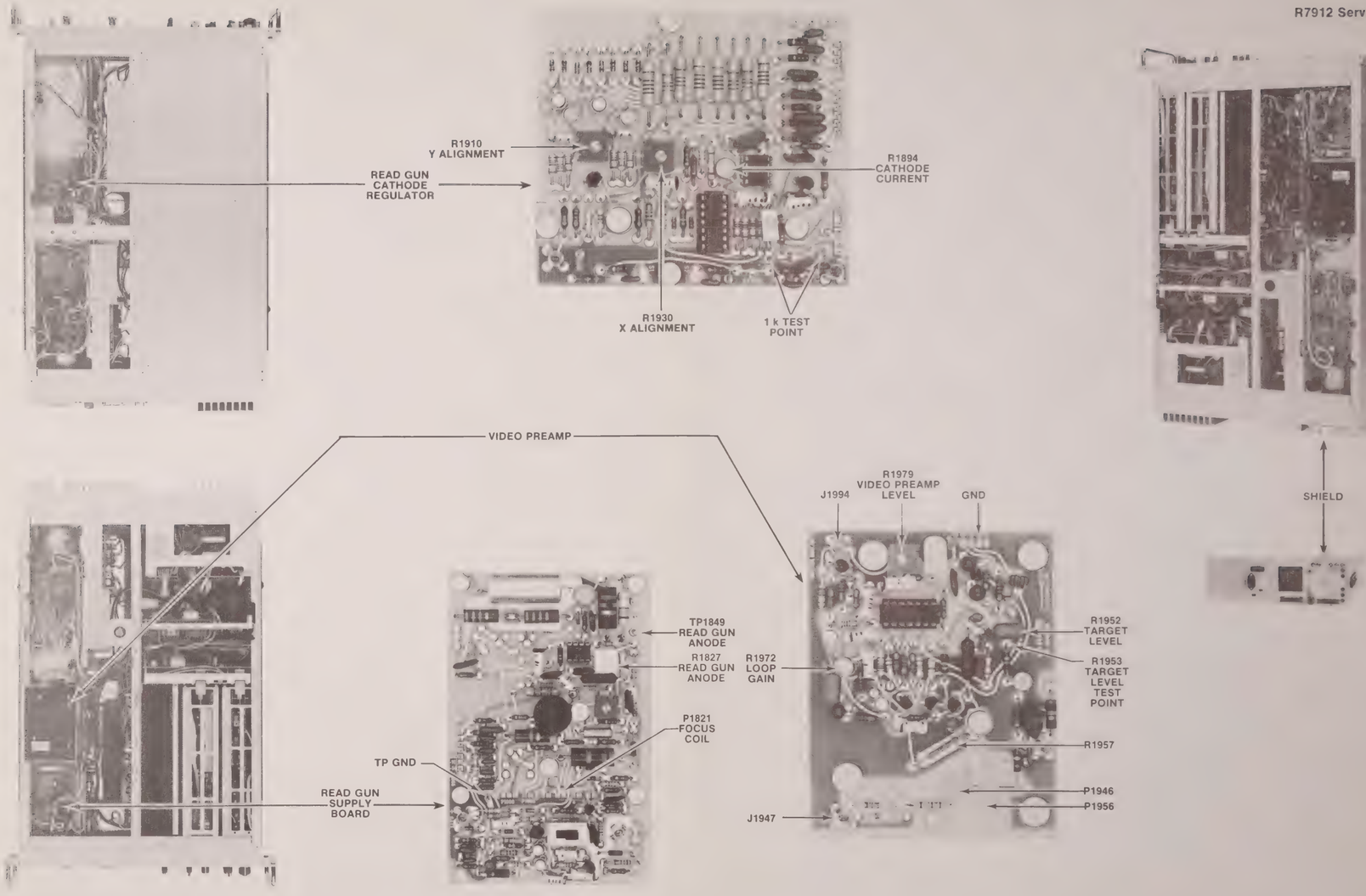


Fig. 8-33. STEPS 9-15. 1590-78

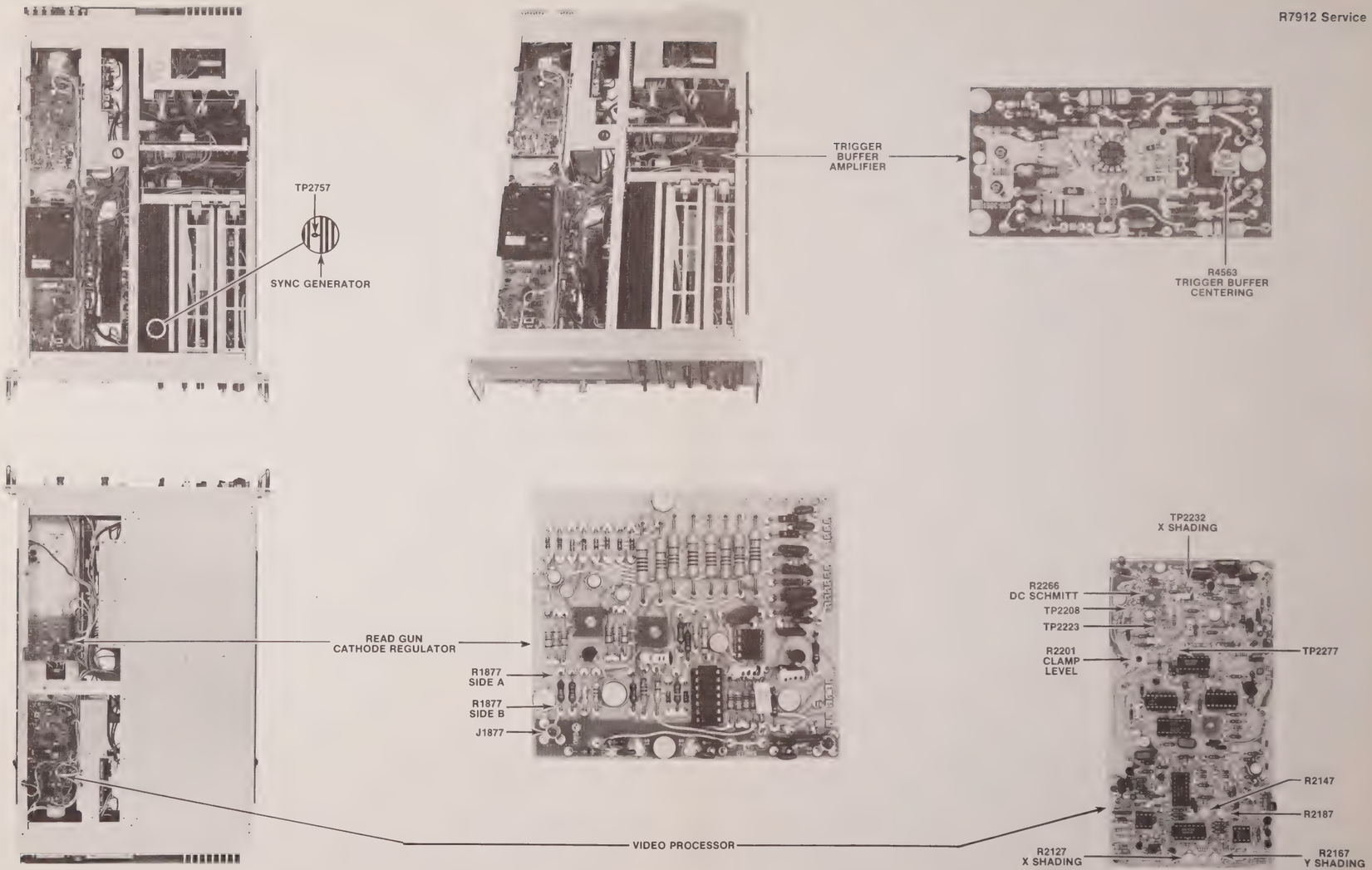


Fig. 8-34. STEPS 16-22. 1590-79

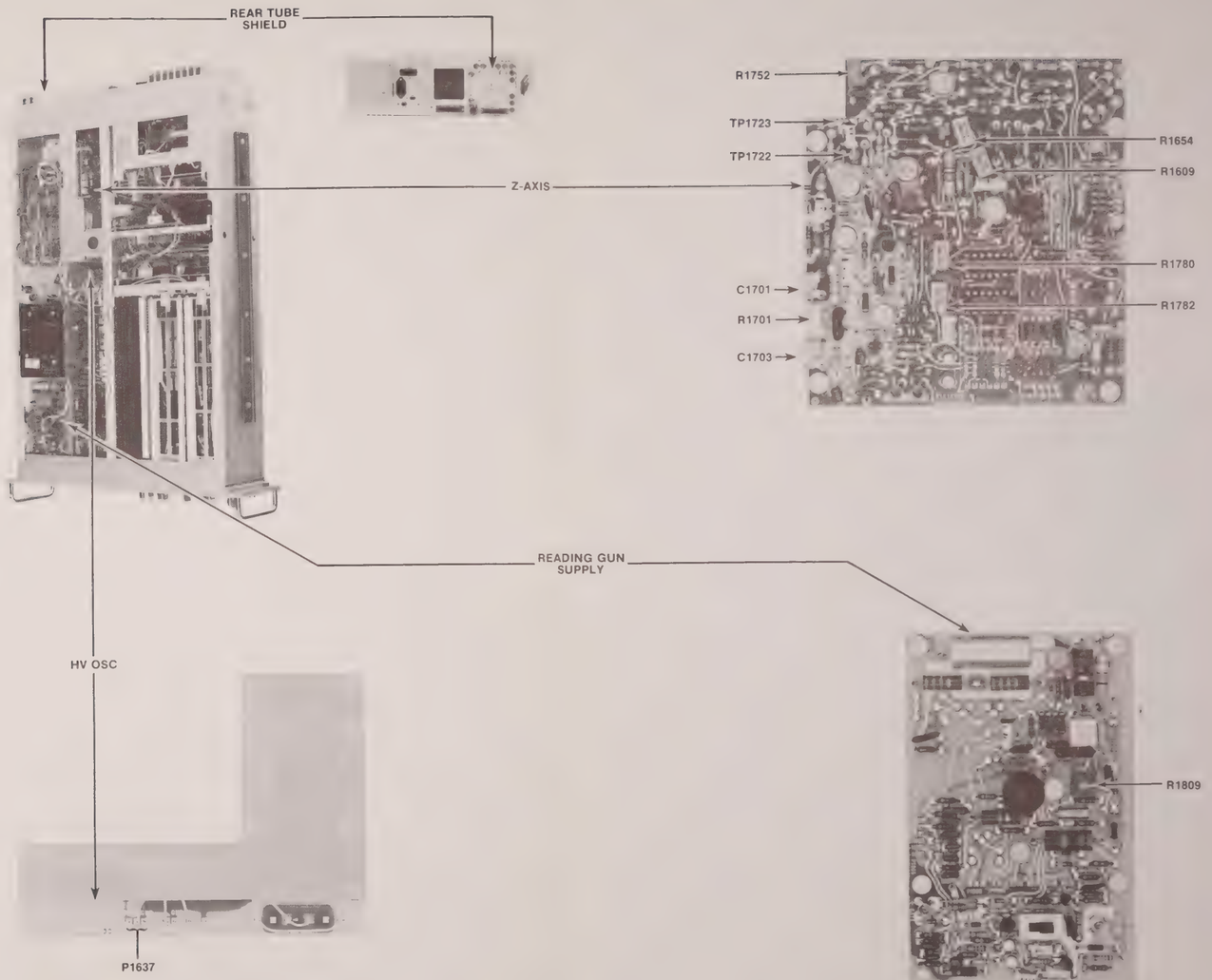


Fig. 8-35. **STEPS 23-27.** 1590-80

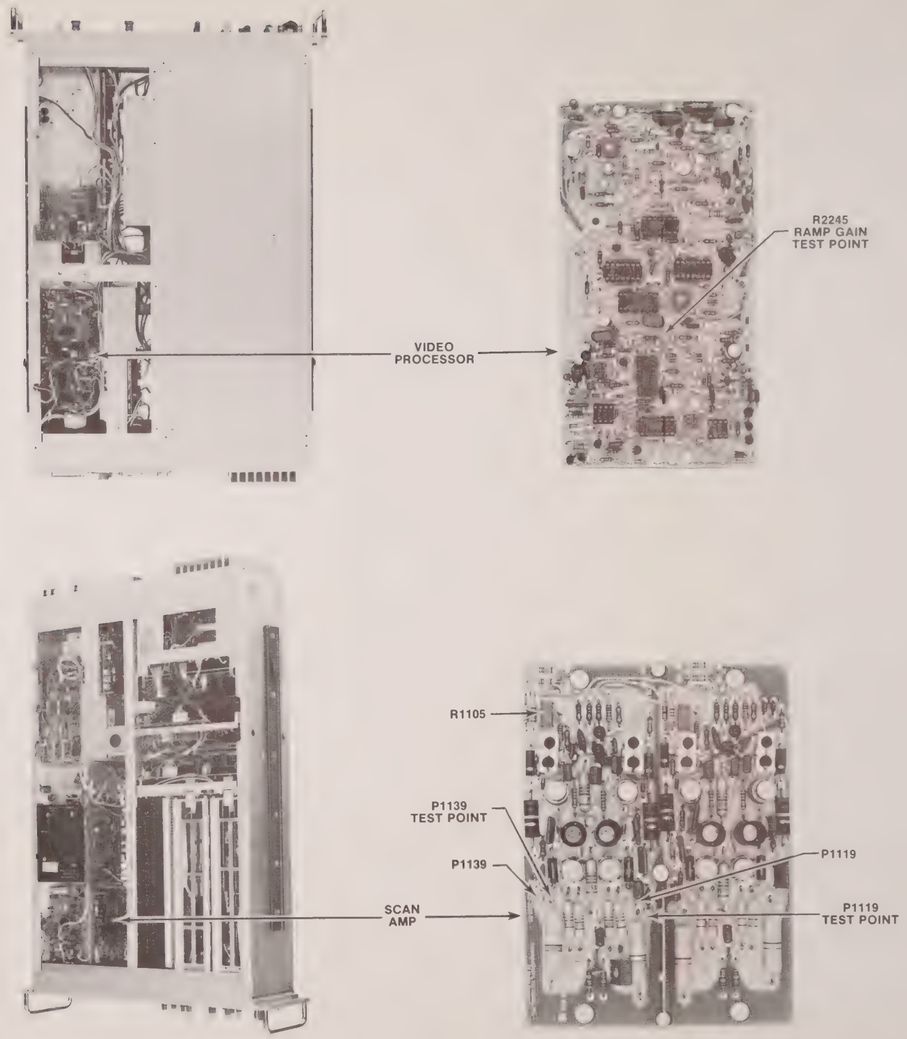


Fig. 8-36. STEPS 28-30. 1590-81

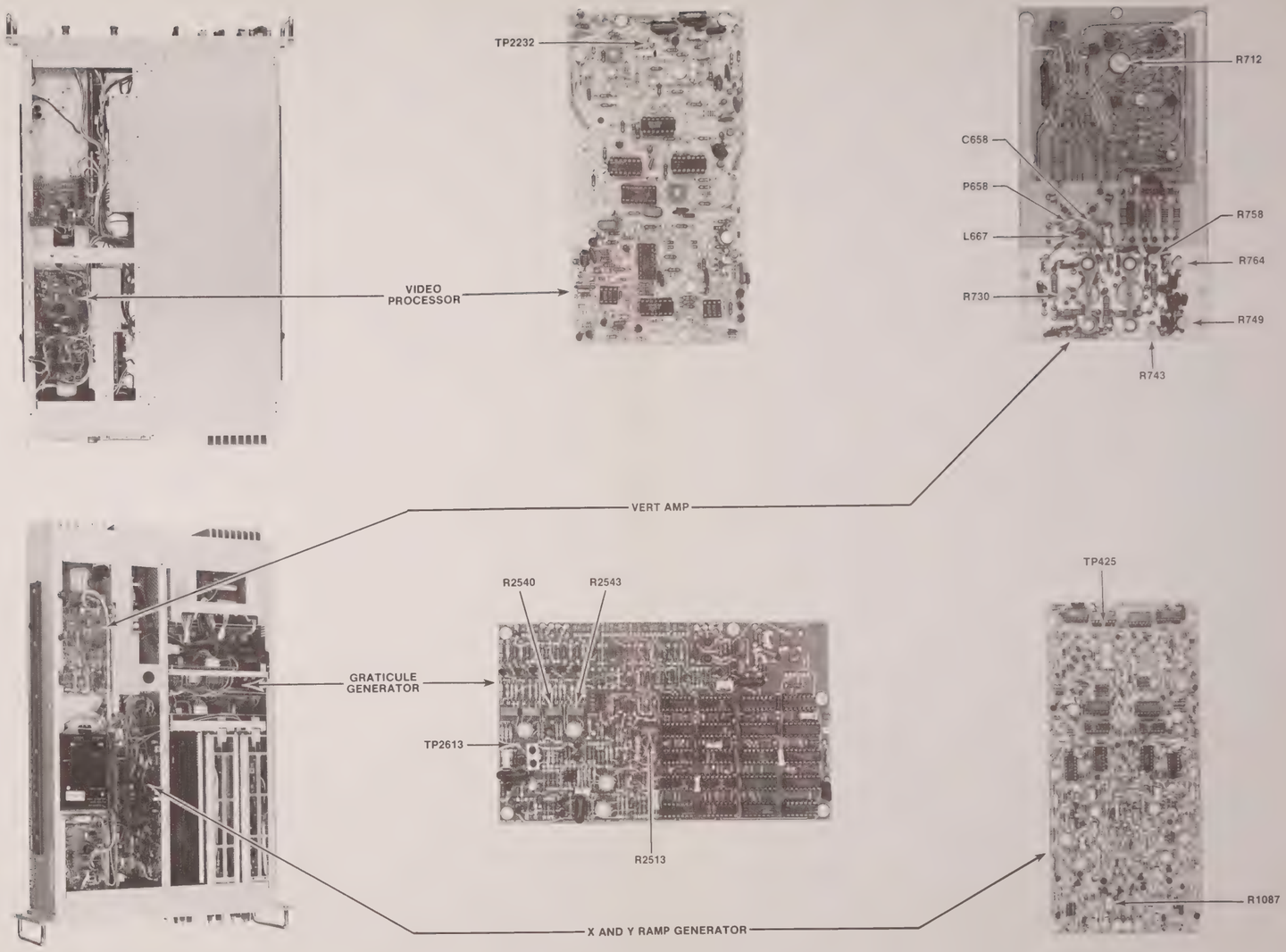


Fig. 8-37. STEPS 31-36, 50, 51. 1590-82

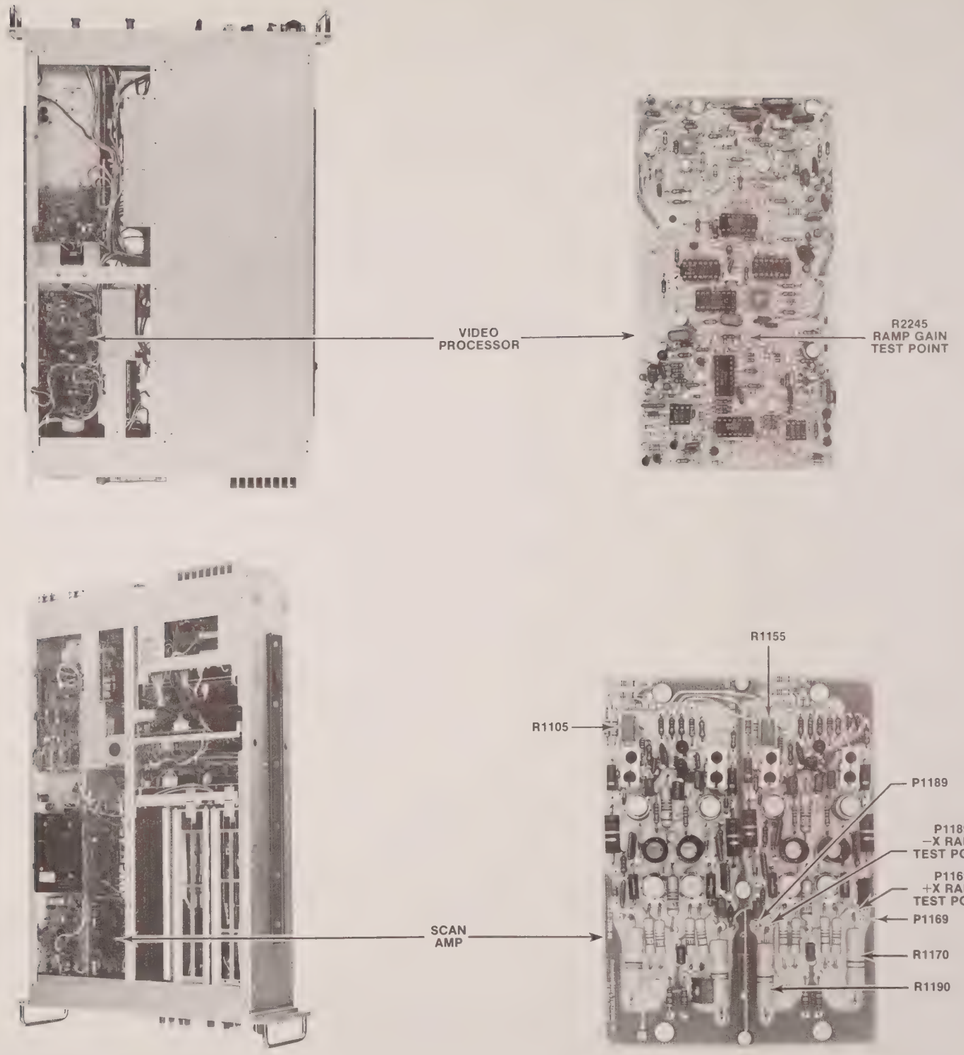


Fig. 8-38. STEPS 37-39. 1590-83

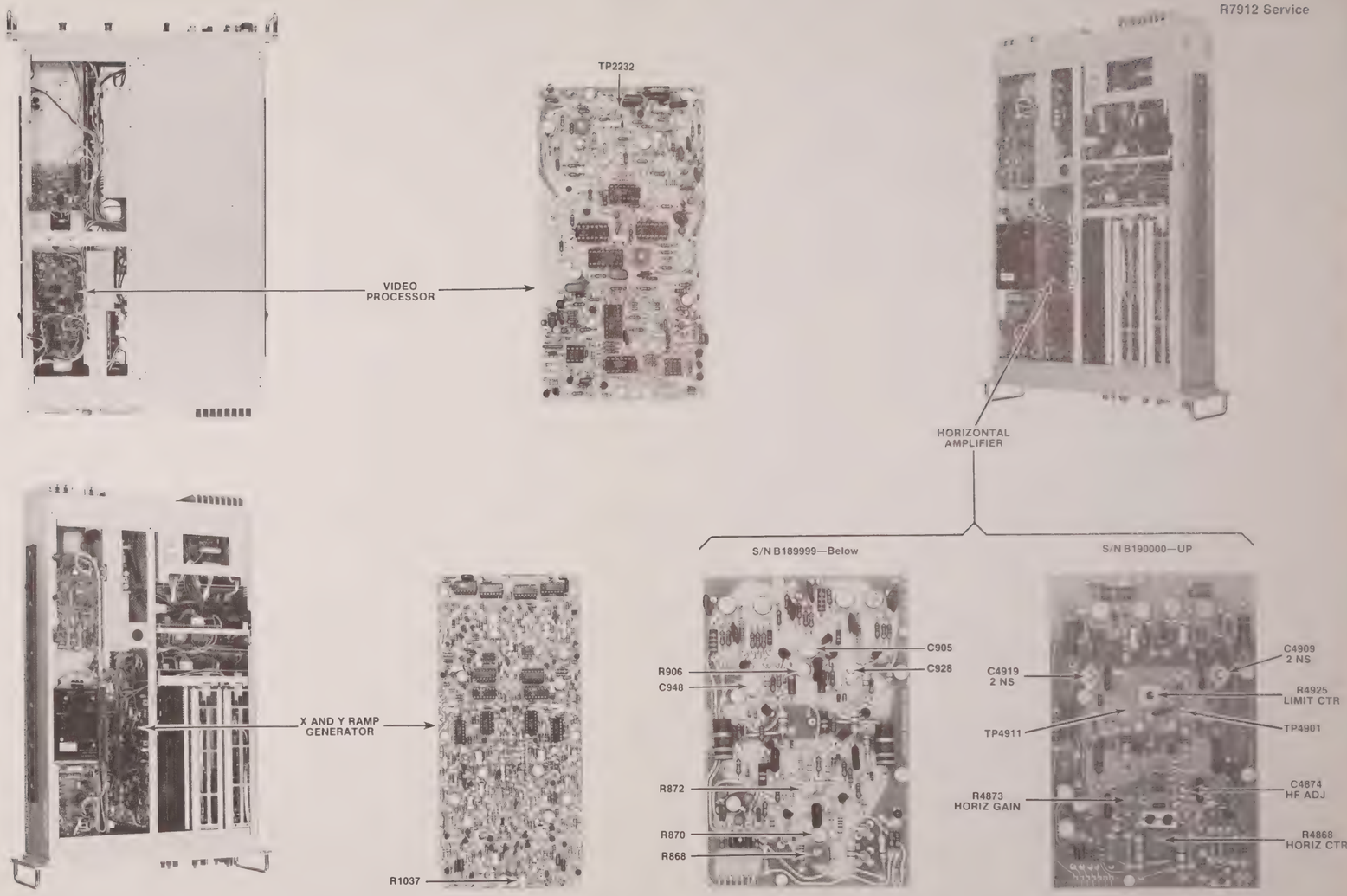


Fig. 8-39. STEP 40, 41, 41A, 46C, 48. 1590-84

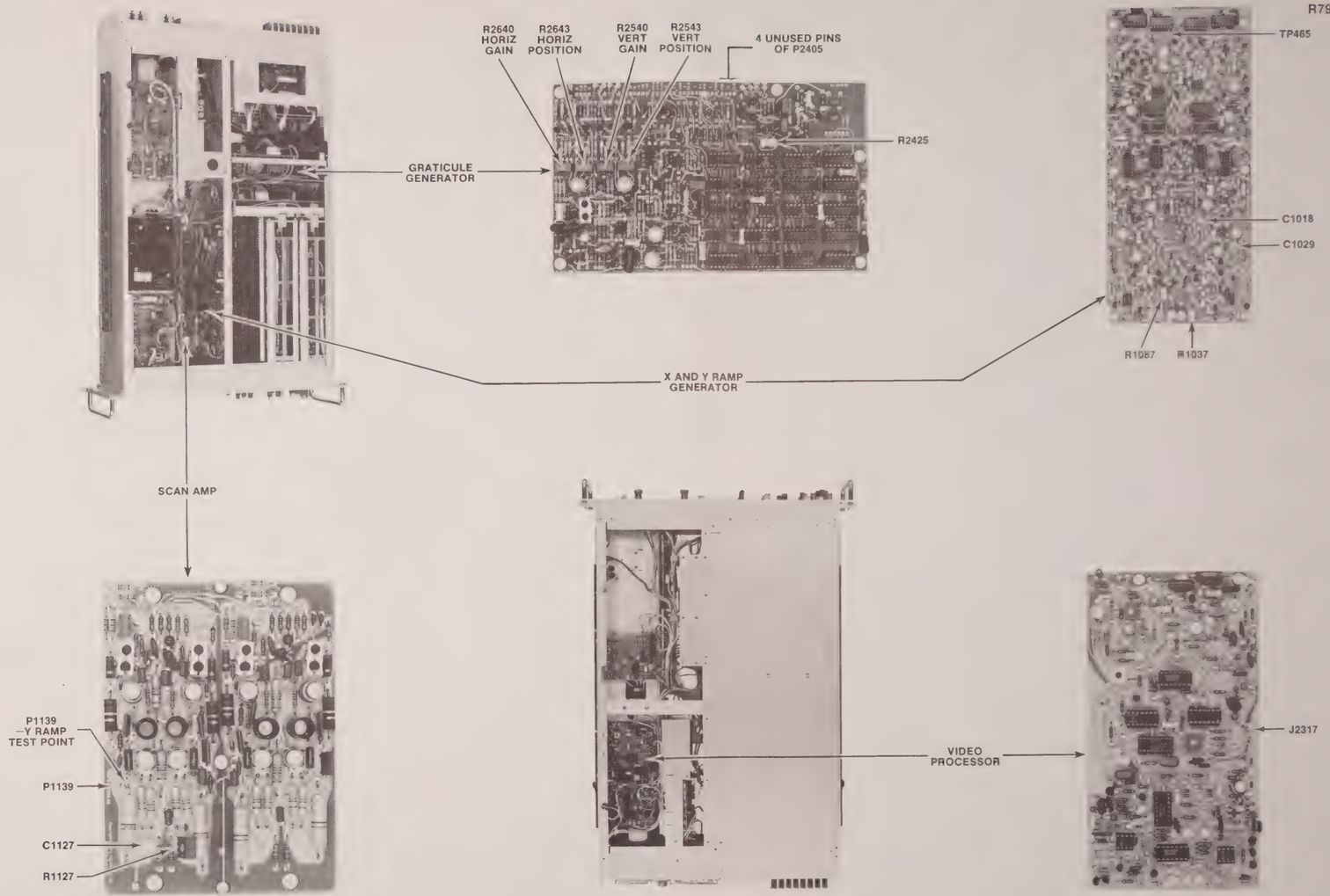


Fig. 8-40. STEPS 42-46c, 49. 1590-85

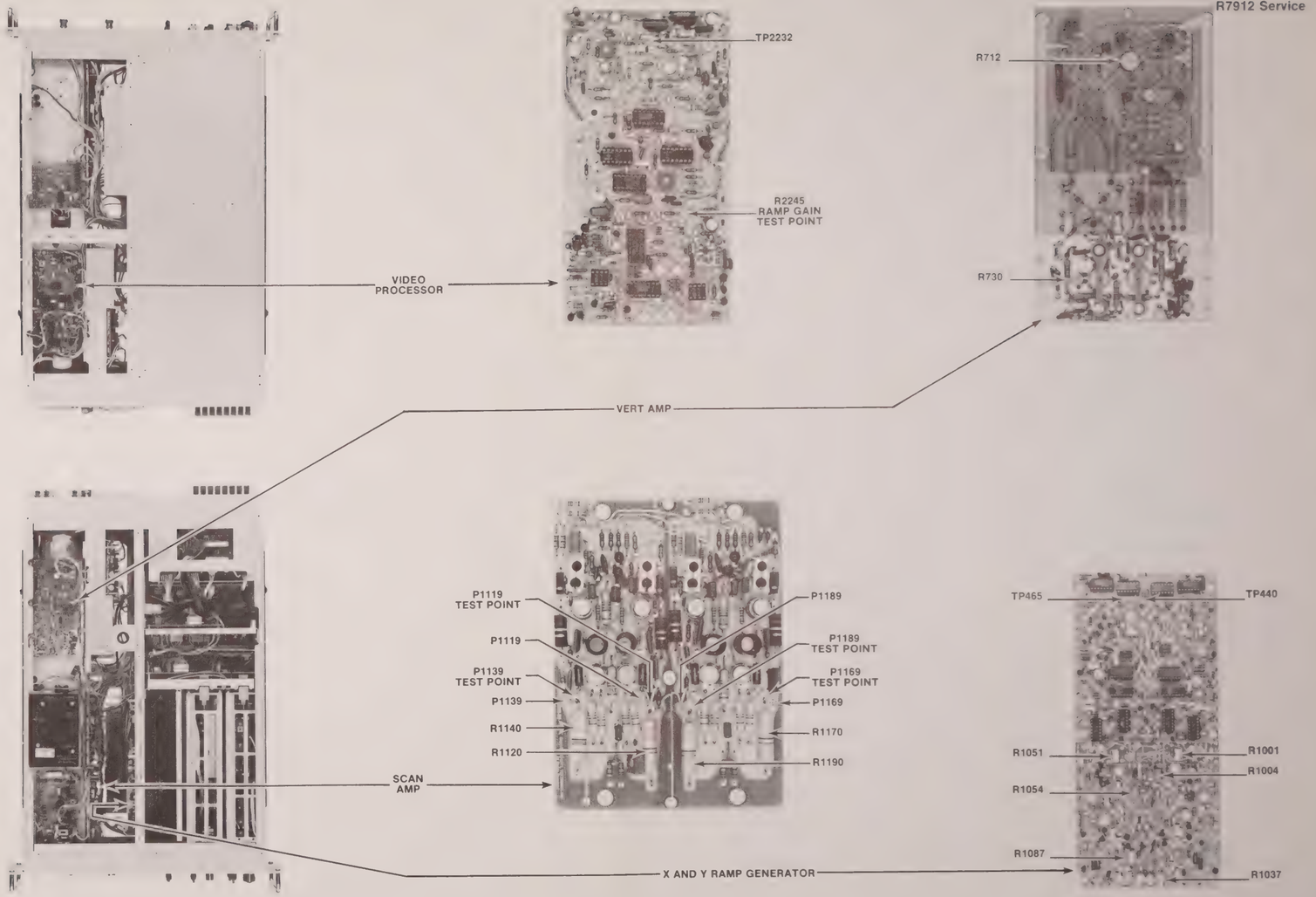


Fig. 8-41. STEPS 46b-53. 1590-86

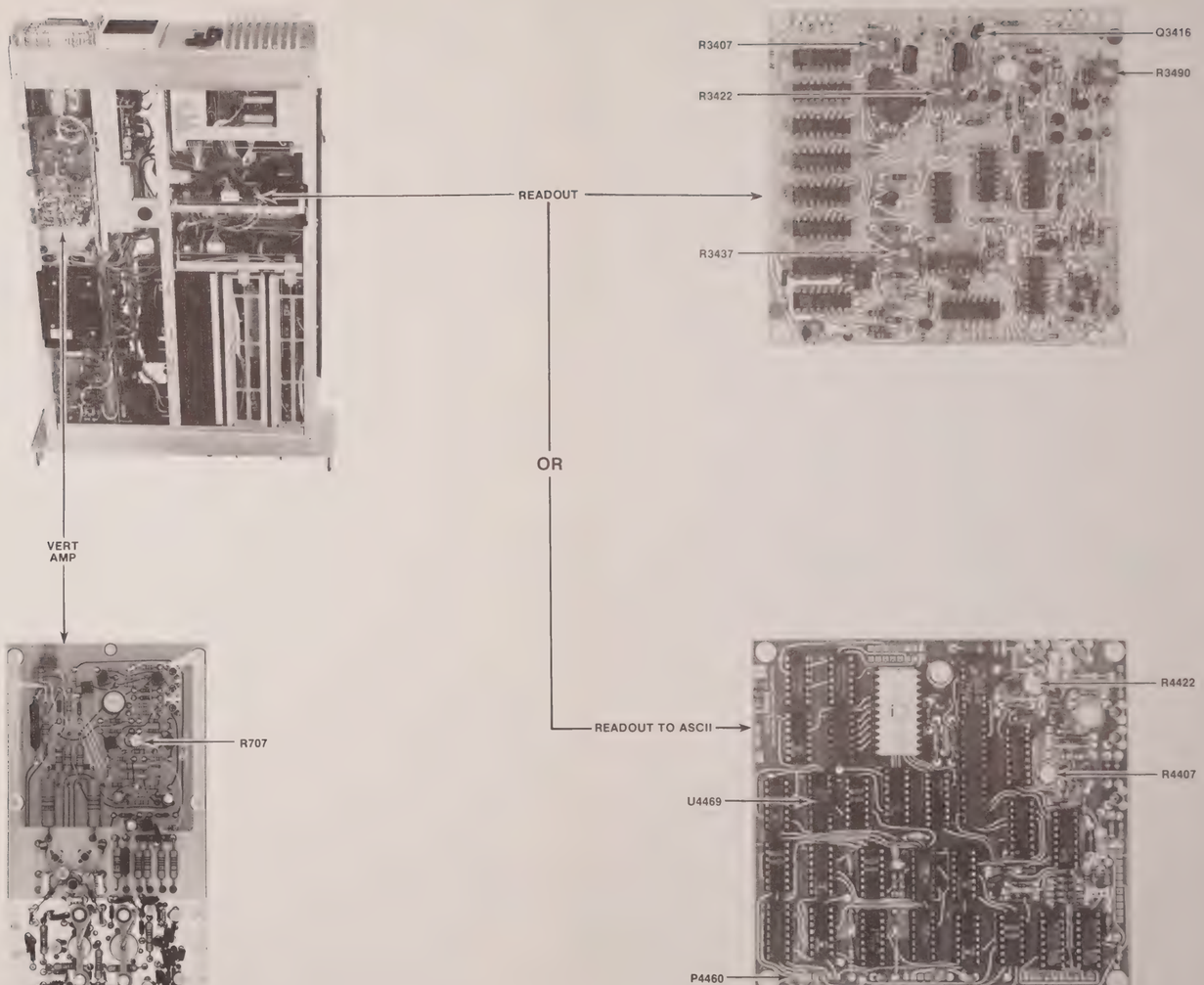


Fig. 8-42. STEPS 54-57. 1590-87

Fig. 8-42. STEPS 54-57.

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

```
1 2 3 4 5                    Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
                  - - - * - - -
   Detail Part of Assembly and/or Component
   Attaching parts for Detail Part
                  - - - * - - -
      Parts of Detail Part
      Attaching parts for Parts of Detail Part
                  - - - * - - -
```

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-41	----- -----			1	CKT BOARD ASSY:CALIBRATOR(SEE A3 EPL)		
					(ATTACHING PARTS)		
-42	210-0586-00			2	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
-43	211-0116-00			2	SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-44	131-0608-00			11	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-45	131-1003-00			1	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-46	136-0252-04			20	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-47	214-0579-00			1	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-48	260-1445-00			1	. SWITCH,PUSH:	80009	260-1445-00
-49	337-1977-00			1	. SHIELD,ELEC:PUSH SWITCH	80009	337-1977-00
-50	407-1306-00			2	BRACKET,CKT BD:	80009	407-1306-00
					(ATTACHING PARTS FOR EACH)		
-51	210-0586-00			1	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-52	----- -----			1	CKT BOARD ASSY:MODE SWITCH(SEE A4 EPL)		
					(ATTACHING PARTS)		
-53	220-0679-00			2	NUT BAR:0.25 SQ X 6.9 INCH LONG	80009	220-0679-00
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-54	131-0608-00			14	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-55	136-0252-04	XB010202		6	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-56	366-1109-19			1	. PUSHBUTTON:DIGITAL	80009	366-1109-19
-57	366-1109-20			1	. PUSHBUTTON:NOW STORE	80009	366-1109-20
-58	366-1109-21			1	. PUSHBUTTON:STORE	80009	366-1109-21
-59	366-1109-22			1	. PUSHBUTTON:ERASE	80009	366-1109-22
-60	200-0983-00			1	BEZEL:PLASTIC,4 BUTTON SWITCH	80009	200-0983-00
-61	352-0360-00			1	HOLDER,LED:0.086 ID X 0.20 I OD,PLSTC	80009	352-0360-00
-62	354-0350-00	B010100	B020190	2	RING,RETAINING:0.073"FREE ID X 0.015",STL	79136	5133-9 MD
	354-0311-00	B020191		2	RING,RUBBER:0.078 ID X 0.062 DIA	07322	8004-366Y
-63	211-0155-00	B010100	B099999	2	SCREW,EXT,RLV B:4-40 X 0.375 INCH,SST	80009	211-0155-00
	211-0205-00	B100000		2	SCREW,MACHINE:4-40 X 0.42 INCH,RDH SST	80009	211-0205-00
-64	381-0345-00			1	BAR,LATCH:	80009	381-0345-00
					(ATTACHING PARTS)		
-65	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-66	334-2152-00			1	MARKER,IDENT:DANGER,W/ARROW	22670	OBD
-67	386-2622-00			1	SUBPANEL,FRONT:	80009	386-2622-00
-68	210-1014-00			2	WASHER,NONMETAL:0.094 ID X 0.312" OD,TEFLON	80009	210-1014-00
-69	210-0405-00			2	NUT,PLAIN,HEX.:2-56 X 0.188 INCH,BRS	73743	2X12157-402
-70	407-1391-00			2	BRACKET,HINGE:	80009	407-1391-00
					(ATTACHING PARTS FOR EACH)		
-71	211-0101-00			2	SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-72	348-0354-00			4	SHLD GSKT,ELEC:8.10 INCH LONG	80009	348-0354-00
-73	348-0141-00			1	GROMMET,PLASTIC:U-SHP,0.625 X0.658 INCH	80009	348-0141-00
-74	351-0305-01			2	GUIDE,PLUG-IN:UPPER	80009	351-0305-01
					(ATTACHING PARTS FOR EACH)		
-75	211-0105-00			1	SCREW,MACHINE:4-40 X 0.188"100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-76	367-0022-00			2	HANDLE,BOW:1.5 X 4.5 INCH	06540	10353-B-1032-25A
					(ATTACHING PARTS FOR EACH)		
-77	212-0507-00			2	SCREW,MACHINE:10-32 X 0.375 INCH,PNH STL	83385	OBD
-78	210-0010-00			2	WASHER,LOCK:INT,0.20 ID X0.376" OD,STL	78189	1210-00-00-0541C
					- - - * - - -		
-79	334-2151-00			2	MARKER,IDENT:DANGER,W/O ARROW	22670	OBD
-80	----- -----			1	CKT BOARD ASSY:X/Y RAMA GEN(SEE A10 EPL)		
					(ATTACHING PARTS)		
-81	129-0338-00			6	POST,ELEC-MECH:HEX.,0.188 X 0.64 INCH LONG	80009	129-0338-00
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-82	131-0608-00			32	. CONTACT,ELEC:0.365 INCH LONG	22526	47357

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-83	131-1003-00			6	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-84	136-0252-04			196	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-85	136-0269-02			12	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-86	214-0579-00			24	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-87	337-1833-00			2	. SHIELD,ELEC:VARIABLE RESISTOR	80009	337-1833-00
-88	343-0072-00			2	CLAMP,LOOP:0.50 INCH	95981	1-2-4NA
					(ATTACHING PARTS FOR EACH)		
-89	211-0121-00			1	SCR,ASSEM WASH.:4-40 X 0.438 INCH,PNH BRS	83385	OBD
					- - - * - - -		
-90	----- -----			1	CKT BOARD ASSY:DISTRIBUTION(SEE A30 EPL)		
					(ATTACHING PARTS)		
-91	211-0008-00			4	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-92	131-0589-00			16	. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0608-00			175	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-93	131-1003-00			14	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-94	136-0252-04			14	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-95	136-0432-00	B010100 B010141		1	. SOCKET,PLUG-IN:24 CONTACT	71785	133-59-02-011
	136-0586-00	B010142		1	. SKT PL-IN ELEK:	09922	GTHZ24P-1
-96	214-0579-00			8	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-97	441-1164-00			1	CHAS,TRANSIENT DIGITIZER:DIST BOARD	80009	441-1164-00
					(ATTACHING PARTS)		
-98	211-0101-00			2	SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-99	210-0223-00			1	TERMINAL,LUG:0.25 INCH DIA,SE	78189	2101-14-03-2520N
					(ATTACHING PARTS)		
-100	211-0008-00			1	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-101	210-0586-00			1	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-102	260-1195-00			1	SWITCH,SLIDE:	82389	46313
					(ATTACHING PARTS)		
-103	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-104	210-0586-00			2	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-105	381-0347-00			1	BAR,SUPPORT:	80009	381-0347-00
					(ATTACHING PARTS)		
-106	211-0114-00			4	SCREW,MACHINE:4-40 X 0.438 INCH,FLH STL	83385	OBD
-107	210-0586-00			4	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-108	348-0006-00			1	GROMMET,RUBBER:0.562 ID X 0.875 INCH OD	70485	1720
-109	386-2579-00			1	SUPPORT,CHASSIS:HIGH VOLTAGE	80009	386-2579-00
					(ATTACHING PARTS)		
-110	211-0101-00			2	SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
-111	210-0586-00			2	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-112	343-0072-00			1	CLAMP,LOOP:0.50 INCH	95987	1-2-4NA
					(ATTACHING PARTS)		
-113	211-0507-00			1	SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-114	210-0803-00			1	WASHER,FLAT:0.15 ID X 0.375 INCH OD,STL	12327	OBD
-115	210-0457-00			1	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		
-116	210-0202-00			1	TERMINAL,LUG:SE #6	78189	2104-06-00-2520N
					(ATTACHING PARTS)		
-117	211-0504-00			1	SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
-118	210-0457-00			1	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		
-119	255-0334-00			FT	PLASTIC CHANNEL:12.75 INCHES LONG	80009	255-0334-00
-120	----- -----			1	CKT BOARD ASSY:TRIGGER BUFFER(SEE A34 EPL)		
					(ATTACHING PARTS)		
-121	211-0008-00	XB090000		3	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-122	131-0608-00	XB090000		4	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-123	131-1003-00	XB090000		4	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-124	136-0252-04	XB090000		15	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-125	407-1634-00	XB090000		1	BRACKET,CKT BD:	80009	407-1634-00
					(ATTACHING PARTS)		
-126	211-0008-00	XB090000		2	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-127	386-2772-00			1	SUPPORT,CHASSIS:READOUT	80009	386-2772-00
					(ATTACHING PARTS)		
-128	211-0008-00			4	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-129	391-0114-00			2	BLK,PWR SPLY MO:	80009	391-0114-00
					(ATTACHING PARTS FOR EACH)		
-130	211-0559-00			1	SCREW,MACHINE:6-32 X 0.375"100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-131	386-2581-00			2	SPRT,SUBPANEL:REAR LEFT AND RIGHT SIDE	80009	386-2581-00
					(ATTACHING PARTS FOR EACH)		
-132	211-0507-00			1	SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-133	351-0313-00			PR	GUIDE,SLIDE:RACKMOUNT LEFT AND RIGHT	80009	351-0313-00
					(ATTACHING PARTS)		
-134	210-0458-00			11	NUT,PLAIN,EXT W:8-32 X 0.344 INCH,STL	83385	OBD
-135	211-0504-00			1	SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-136	437-0157-00			1	CAB,TRANSIENT:	80009	437-0157-00
-137	211-0538-00			4	SCREW MACHINE:6-32 X 0.312" 100 DEG,FLH STL	83385	OBD

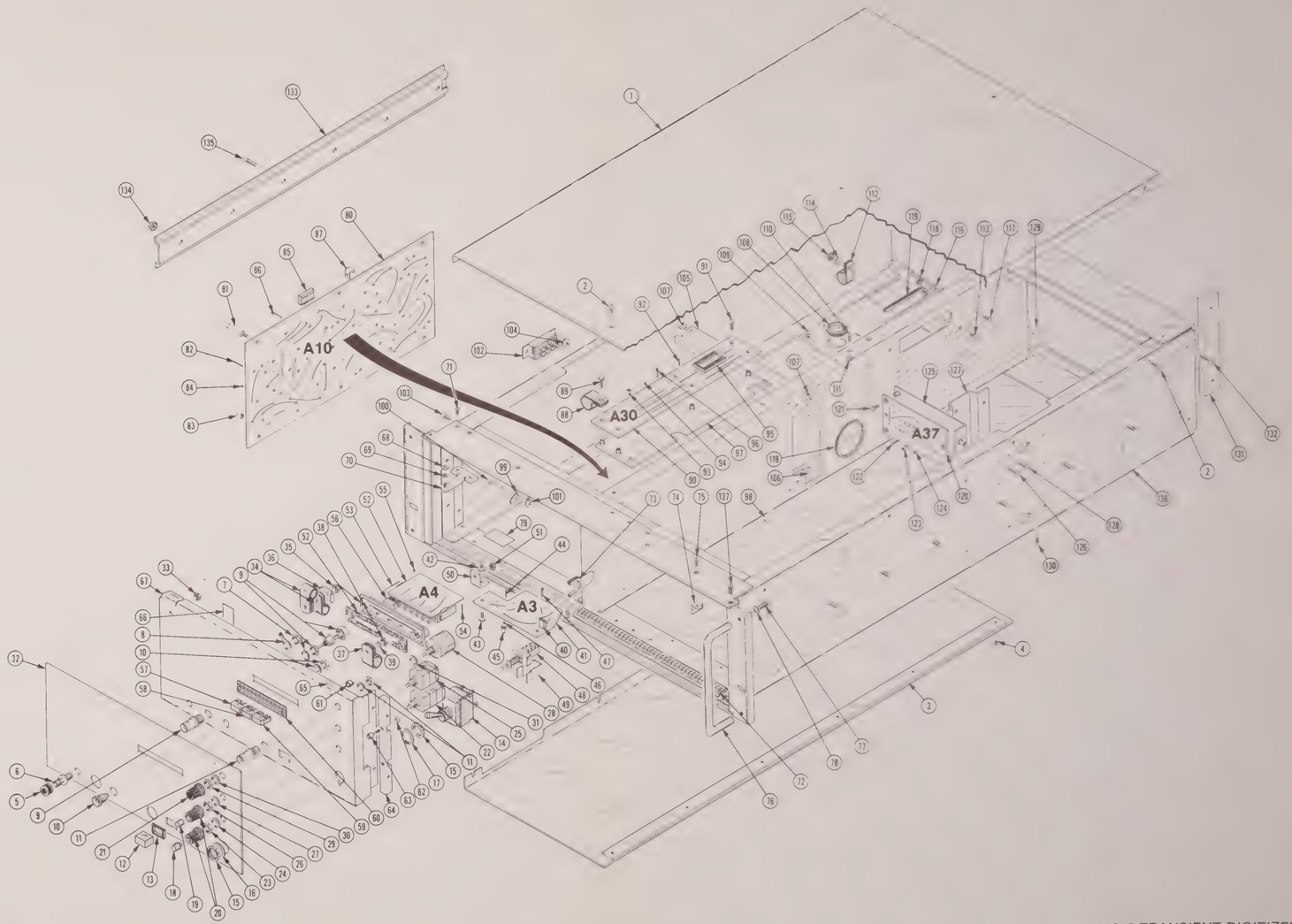


FIG. 1 CHASSIS & FRONT PANEL

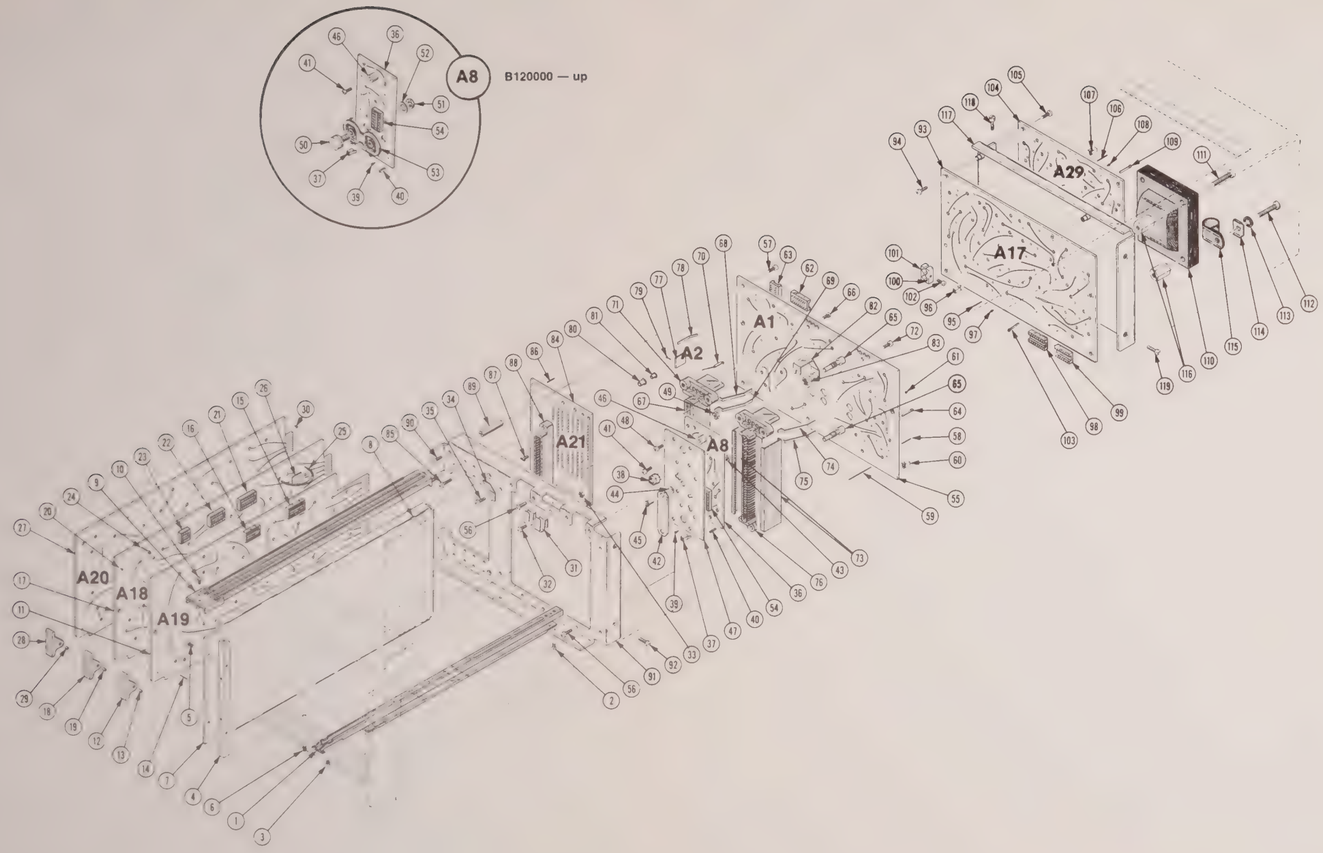

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Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-1	351-0295-02			2		GUIDE,SLIDE:	80009	351-0295-02
						(ATTACHING PARTS FOR EACH)		
-2	213-0088-00			1		SCR,TPG,THD CTG:4-24 X 0.25 INCH,PNH STL	83385	OBD
-3	211-0105-00			1		SCREW,MACHINE:4-40 X 0.188"100 DEG,FLH STL	83385	OBD
						- - - * - - -		
-4	386-2580-00			1		SPRT,SUBPANEL:FRONT RIGHT	80009	386-2580-00
						(ATTACHING PARTS)		
-5	211-0008-00			2		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-6	211-0117-00			2		SCREW,MACHINE:4-40 X 0.312 INCH,PNH,SST	70318	OBD
						- - - * - - -		
-7	337-1809-00			1		SHIELD,ELEC:	80009	337-1809-00
						(ATTACHING PARTS)		
-8	211-0504-00			2		SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
-9	351-0368-00			4		GUIDE,CKT BD:	80009	351-0368-00
						(ATTACHING PARTS FOR EACH)		
-10	213-0120-00			1		SCR,TPG,THD FOR:2-32 X 0.250 INCH,PNH STL	83385	OBD
						- - - * - - -		
-11	----- -----			1		CKT BOARD ASSY:DATA TIMER(SEE A19 EPL)		
-12	105-0144-00			1		. EJECTOR,CKT CD:MOLD PLASTIC,W/ROLL PIN	18677	OBD
						(ATTACHING PARTS)		
-13	214-1337-00			1		. PIN,SPRING:0.10 OD X 0.25 INCH L,STL	80009	214-1337-00
						- - - * - - -		
-14	131-0589-00	XB010142		2		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-15	136-0260-02			9		. SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
-16	136-0269-02	B010100	B010141	22		. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
	136-0269-02	B010142		24		. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-17	----- -----			1		CKT BOARD ASSY:SYNC GENERATOR(SEE A18 EPL)		
-18	105-0144-00			1		. EJECTOR,CKT CD:MOLD PLASTIC,W/ROLL PIN	18677	OBD
						(ATTACHING PARTS)		
-19	214-1337-00			1		. PIN,SPRING:0.10 OD X 0.25 INCH L,STL	80009	214-1337-00
						- - - * - - -		
-20	136-0252-04	B010100	B010141	425		. CONTACT,ELEC:0.188 INCH LONG	22526	75060
	136-0252-04	B010142	B199999	14		. CONTACT,ELEC:0.188 INCH LONG	22526	75060
	136-0252-04	B200000		8		. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-21	136-0260-02	B130000	B199999	7		. SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
	136-0260-02	B200000		2		. SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C93162
-22	136-0269-02	B130000	B199999X	21		. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-23	136-0514-00	B130000	B199999X	1		. SOCKET,PLUG-IN:MICROCIRCUIT,8 CONTACT	82647	C930802
-24	214-0579-00			1		. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-25	352-0096-00	B010100	B039999	1		. CLIP,SPR,TNSN:CRYSTAL	80009	352-0096-00
	346-0032-00	B040000		1		. STRAP,RETAINING:	98159	2829-75-4
-26	253-0059-00[1]	B040000		FT		. TAPE,PRESS SENS:0.052 INCH LONG	83309	P243
-27	----- -----[1]			1		CKT BOARD ASSY:MEMORY(SEE A20 EPL)		
-28	105-0144-00			1		. EJECTOR,CKT CD:MOLD PLASTIC,W/ROLL PIN	18677	OBD
						(ATTACHING PARTS)		
-29	214-1337-00[1]			1		. PIN,SPRING:0.10 OD X 0.25 INCH L,STL	80009	214-1337-00
						- - - * - - -		
-30	136-0252-04[1]			1103		. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-31	131-0930-00			2		CONTACT,ELEC:PLUG-IN GROUND	80009	131-0930-00
						(ATTACHING PARTS FOR EACH)		
-32	211-0008-00			1		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-33	210-0586-00			1		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		
-34	131-1018-00			4		CONTACT,ELEC:PLUG-IN GROUND	80009	131-1018-00
						(ATTACHING PARTS FOR EACH)		
-35	213-0138-00			1		SCR,TPG,THD FOR:4-40 X 0.188 INCH,PNH STL	83385	OBD
						- - - * - - -		
-36	----- -----			1		CKT BOARD ASSY:VERT INTERFACE(SEE A8 EPL)		
-37	131-1003-00			6		. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-38	136-0220-00	B010100	B139999X	2		. SOCKET,PLUG-IN:3 PIN,SQUARE	71785	133-23-11-034
-39	136-0252-00	B010100	B139999	28		. CONTACT,ELEC:0.145 INCH LONG	00779	2-330808-7
	136-0252-00	B140000		32		. CONTACT,ELEC:0.145 INCH LONG	00779	2-330808-7
	136-0252-04	B010100	B139999	2		. CONTACT,ELEC:0.188 INCH LONG	22526	75060
	136-0252-04	B140000		12		. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-40	136-0263-03	B010100	B139999	5		. CONTACT,ELEC:FOR 0.025 INCH SQUARE PIN	00779	86250-2

[1]Option 14 only.

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
2-	136-0263-04	B140000		5	. CONTACT,ELEC:0.025 INCH SQUARE PIN	22526	75377-001
-41	211-0155-00			2	. SCREW,EXT,RLV B:4-40 X 0.375 INCH,SST	80009	211-0155-00
-42	343-0342-01	B010100	B139999X	1	. HOLD DOWN,IC:	80009	343-0342-01
					(ATTACHING PARTS)		
-43	211-0008-00	B010100	B139999X	1	. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-44	210-1002-00	B010100	B139999X	1	. WASHER,FLAT:0.125 ID X 0.25 INCH OD,BRS	12327	OBD
-45	210-0599-00			1	. NUT,SLEEVE:4-40 X 0.391 INCH LONG	80009	210-0599-00
					- - - * - - -		
-46	361-0238-00			2	. SPACER,SLEEVE:0.25 OD X 0.34 INCH LONG	80009	361-0238-00
-47	214-1690-00	B010100	B139999X	1	. HEAT SINK,ELEC:TRANSISTOR	80009	214-1690-00
					(ATTACHING PARTS)		
-48	211-0008-00	B010100	B139999X	2	. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-49	210-0586-00	B010100	B139999X	2	. NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-50	----- -----	XB120000		1	. MICROCKT,LINEAR:FREQ DIFF AMPL(SEE U4625,U4685 EPL)		
					(ATTACHING PARTS)		
-51	210-0406-00	XB120000		2	. NUT,PLAIN,HEX:4-40 X 0.188 INCH,BRS	73743	OBD
-52	210-0906-00	XB120000		2	. WASHER,NONMETAL:FIBER,0.125 ID X 0.203 OD	86445	OBD
					- - - * - - -		
-53	131-1429-00	XB120000		1	. CONTACT,ELEC:IC GROUND,DUAL	80009	131-1429-00
-54	136-0269-02	XB140000		1	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
	672-0065-00			1	CIRCUIT BD ASSY:INTERFACE AND FOLLOWER	80009	672-0065-00
-55	----- -----			1	. CKT BOARD ASSY:MAIN INTERFACE(SEE A1 EPL)		
					(ATTACHING PARTS)		
-56	213-0263-00			6	. SCREW,TDG,TF:4-40 X 0.375 INCH,PNH STL	83385	OBD
-57	211-0008-00			2	. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. . CKT BOARD ASSY INCLUDES:		
-58	131-0589-00			15	. . CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0608-00			108	. . CONTACT,ELEC:0.365 INCH LONG	22526	47357
-59	131-0592-00			5	. . CONTACT,ELEC:0.885 INCH LONG	22526	47353
-60	131-1003-00			15	. . CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-61	136-0252-04			42	. . CONTACT,ELEC:0.188 INCH LONG	22526	75060
-62	136-0260-02			5	. . SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
-63	136-0269-02			2	. . SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-64	214-0579-00			9	. . TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-65	351-0227-00			2	. . GUIDE-POST,LOCK:0.84 INCH LONG	80009	351-0227-00
	131-0767-05			1	. . CONNECTOR,RCPT,:	80009	131-0767-05
					(ATTACHING PARTS)		
-66	213-0232-00			2	. . SCR,TPG,THD FOR:2-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. . . CONNECTOR INCLUDES:		
-67	200-0950-00			2	. . . COVER,ELEC CONN:PLASTIC	80009	200-0950-00
-68	131-0727-00			32	. . . CONTACT,ELEC:OFFSET	80009	131-0727-00
-69	131-0726-00			32	. . . CONTACT,ELEC:STRAIGHT	80009	131-0726-00
-70	214-1665-00			1	. . . SPRING,FLAT,:50 OHM EDGE BOARD CONN	80009	214-1665-00
-71	204-0365-02			1	. . . BODY,CONNECTOR:PLUG-IN CIRCUIT BOARD	80009	204-0365-02
	131-0767-07			1	. . CONNECTOR,RCPT,:PLUG-IN CKT BD,70 CONTACT	80009	131-0767-07
					(ATTACHING PARTS)		
-72	213-0232-00			2	. . SCR,TPG,THD FOR:2-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. . . CONNECTOR INCLUDES:		
-73	200-0950-00			2	. . . COVER,ELEC CONN:PLASTIC	80009	200-0950-00
-74	131-0727-00			35	. . . CONTACT,ELEC:OFFSET	80009	131-0727-00
-75	131-0726-00			35	. . . CONTACT,ELEC:STRAIGHT	80009	131-0726-00
-76	204-0365-02			1	. . . BODY,CONNECTOR:PLUG-IN CIRCUIT BOARD	80009	204-0365-02
-77	----- -----			2	. CKT BOARD ASSY:FOLLOWER(SEE A2 EPL)		
-78	131-1149-00			6	. . CONTACT,ELEC:CKT BOARD EDGE	80009	131-1149-00
-79	210-0657-01			1	. . EYELET,METALLIC:0.089 OD X 0.218 INCH LONG	80009	210-0657-01
-80	210-0774-00			4	. . EYELET,METALLIC:0.152 OD X 0.245 INCH L,BRS	80009	210-0774-00
-81	210-0775-00			4	. . EYELET,METALLIC:0.126 OD X 0.23 INCH L,BRS	80009	210-0775-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
2-82	131-0805-00			2	LINK,TERM.CONNE:J-SHAPE,0.90X0.82 X 0.312"	80009	131-0805-00
					(ATTACHING PARTS FOR EACH)		
-83	220-0561-00			1	NUT,PLAIN,HEX.:10-32 X 0.25 INCH,BRS	80009	220-0561-00
					- - - * - - -		
-84	----- -----			-	CKT BOARD ASSY:DATA INTERCONNECT(SEE A21 EPL)		
					(ATTACHING PARTS)		
-85	211-0008-00			8	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-86	131-0589-00			113	. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-87	214-1458-00			4	. KEY,CONNECTOR:	05574	091-0071-00
-88	131-1409-00			4	. CONN,RCPT,ELEC:60 CONTACTS	05574	3VH30/IJV3
	198-3285-00			1	. WIRE SET,ELEC:	80009	198-3285-00
-89	129-0427-00			2	POST,ELEC-MECH:4-40 X 0.188 X 1.056" L HEX	80009	129-0427-00
					(ATTACHING PARTS FOR EACH)		
-90	211-0008-00			1	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-91	407-1301-00			1	BRACKET CONN:	80009	401-1301-00
					(ATTACHING PARTS)		
-92	211-0504-00			4	SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-93	----- -----			1	CKT BOARD ASSY:GRATICULE GEN(SEE A17 EPL)		
					(ATTACHING PARTS)		
-94	211-0008-00			5	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-95	131-0608-00			36	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-96	131-1003-00			4	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-97	136-0252-04			129	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-98	136-0260-02			5	. SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
-99	136-0269-02			15	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-100	200-0945-00			1	. COVER,HALF XSTR:FOR DUAL TO-18 CASE	80009	200-0945-00
-101	200-0945-01			1	. COVER,HALF XSTR:FOR DUAL TO-18 CS,2-56 THD	80009	200-0945-01
					(ATTACHING PARTS)		
-102	211-0001-00			1	. SCREW,MACHINE:2-56 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-103	214-0579-00			10	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-104	----- -----			1	CKT BOARD ASSY:READOUT(SEE A29 EPL)		
					(ATTACHING PARTS)		
-105	211-0008-00			4	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-106	131-0608-00			24	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-107	131-1003-00			5	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-108	136-0252-04			278	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-109	214-0579-00			2	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-110	120-0893-00			1	XFMR,PWR,STPDN:	80009	120-0893-00
					(ATTACHING PARTS)		
-111	212-0033-00	B010100	B159999	3	SCREW,MACHINE:8-32 X 0.750 INCH,PNH STL	83385	OBD
	212-0033-00	B160000		2	SCREW,MACHINE:8-32 X 0.750 INCH,PNH STL	83385	OBD
-112	212-0020-00	B160000		1	SCREW,MACHINE:8-32 X 1.0 INCH,PNH STL	83385	OBD
-113	210-0056-00	XB160000		1	WASHER,LOCK:SPLIT,0.047 ID X 0.32" OD,P BRZ	83385	OBD
-114	210-0863-00	XB160000		1	WSHR,LOOP CLAMP:FOR 0.50" WIDE CLAMP,STL	95987	C191
-115	343-0013-00	XB160000		1	CLAMP,LOOP:0.375 INCH DIA	95987	3-8-6B
					- - - * - - -		
-116	385-0121-00			3	POST,ELEC-MECH:0.562 INCH LONG,8-32 TAPPED	80009	385-0121-00
-117	441-1165-00			1	CHAS,DIGITIZER:READOUT	80009	441-1165-00
					(ATTACHING PARTS)		
-118	211-0155-00	B010100	B099999	1	SCREW,EXT,RLV B:4-40 X 0.375 INCH,SST	80009	211-0155-00
	211-0205-00	B100000		1	SCREW,MACHINE:4-40 X 0.42 INCH,RDH SST	80009	211-0205-00
-119	211-0504-00			3	SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
3-	620-0232-00			1	POWER SUPPLY:	80009	620-0232-00
					(ATTACHING PARTS)		
-1	211-0507-00			4	SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	POWER SUPPLY INCLUDES:		
-2	200-1552-00			1	. COVER,PWR SPLY:TOP	80009	200-1552-00
					(ATTACHING PARTS)		
-3	211-0105-00			4	. SCREW,MACHINE:4-40 X 0.188"100 DEG,FLH STL	83385	OBD
-4	211-0502-00			2	. SCREW,MACHINE:6-32 X 0.188",FLH STL	83385	OBD
					- - - * - - -		
-5	----- -----			5	. TRANSISTOR:(SEE Q1428,1458,1498,1538,1588 EPL)		
					(ATTACHING PARTS FOR EACH)		
-6	211-0559-00			1	. SCREW,MACHINE:6-32 X 0.375"100 DEG,FLH STL	83385	OBD
-7	210-0407-00			1	. NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
-8	210-0071-00			1	. WASHER,SPR TNSN:0.146 ID X 0.323" OD,STL	78189	4706-05-01-0531
					- - - * - - -		
-9	342-0136-00			5	. INSULATOR,WSHR:0.812 OD X 0.0025 INCH THK	80009	342-0136-00
-10	----- -----			1	. CKT BOARD ASSY:LOW VOLTAGE RGLTR(SEE A23 EPL)		
					(ATTACHING PARTS)		
-11	211-0008-00			4	. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. . CKT BOARD ASSY INCLUDES:		
-12	131-0608-00			48	. . CONTACT,ELEC:0.365 INCH LONG	22526	47357
-13	214-1291-00			2	. . HEAT SINK,ELEC:XSTR,0.72 OD X 0.375"H	05820	207-AB
-14	136-0183-00			2	. . SOCKET,PLUG-IN:3 PIN,ROUND	80009	136-0183-00
-15	136-0252-04			78	. . CONTACT,ELEC:0.188 INCH LONG	22526	75060
-16	214-0579-00			8	. . TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-17	441-1128-00			1	. CHASSIS OSCP:	80009	441-1128-00
					(ATTACHING PARTS)		
-18	211-0502-00			4	. SCREW,MACHINE:6-32 X 0.188",FLH STL	83385	OBD
-19	211-0503-00			2	. SCREW,MACHINE:6-32 X 0.188 INCH,PNH STL	83385	OBD
					- - - * - - -		
-20	200-1263-01			1	. COVER,PWR SPLY:RIGHT	80009	200-1263-01
					(ATTACHING PARTS)		
-21	211-0503-00			1	. SCREW,MACHINE:6-32 X 0.188 INCH,PNH STL	83385	OBD
-22	211-0507-00			2	. SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-23	200-1262-02			1	. COVER,PWR SPLY:LEFT	80009	200-1262-02
					(ATTACHING PARTS)		
-24	211-0504-00			2	. SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
-25	211-0503-00			2	. SCREW,MACHINE:6-32 X 0.188 INCH,PNH STL	83385	OBD
-26	211-0507-00			2	. SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-27	348-0070-01			1	. PAD,CUSHIONING:0.69 INCH,RUBBER	80009	348-0070-01
-28	----- -----			1	. CAP.,FXD,ELCTLT:(SEE C1313 EPL)		
					(ATTACHING PARTS)		
-29	212-0518-00			2	. SCREW,MACHINE:10-32 X 0.312 INCH,PNH STL	83385	OBD
-30	210-1092-00			2	. WASHER,FLAT:0.147 ID X 0.312" OD,BRS	12327	OBD
-31	210-0056-00			2	. WASHER,LOCK:SPLIT,0.047 ID X 0.32" OD,P BRZ	83385	OBD
					- - - * - - -		
-32	----- -----			1	. CKT BOARD ASSY:CAP. RECT(SEE A26 EPL)		
					(ATTACHING PARTS)		
-33	211-0504-00			1	. SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
-34	211-0008-00			4	. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. . CKT BOARD ASSY INCLUDES:		
-35	131-0608-00			34	. . CONTACT,ELEC:0.365 INCH LONG	22526	47357
-36	136-0252-04			6	. . CONTACT,ELEC:0.188 INCH LONG	22526	75060
-37	136-0260-02			1	. . SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
-38	136-0263-04			7	. . CONTACT,ELEC:FOR 0.025 INCH SQUARE PIN	00779	86250-2
-39	----- -----			4	. . SEMICOND DVC,DI:(SEE CR1345,1346,1347,1348)		
					(ATTACHING PARTS FOR EACH)		
-40	210-0410-00			1	. . NUT,PLAIN,HEX.:10-32 X 0.312 INCH,BRS	73743	2X20003-402
-41	210-1003-00			1	. . WASHER,FLAT:# 10	12327	OBD
-42	210-0056-00			1	. . WASHER,LOCK:SPLIT,0.047 ID X 0.32" OD,P BRZ	83385	OBD
					- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
3-43	----- -----			2	. . SEMICOND DVC DI:(SEE CR1310,1313 EPL) (ATTACHING PARTS FOR EACH)		
-44	210-0410-00			1	. . NUT,PLAIN,HEX.:10-32 X 0.312 INCH,BRS	73743	2X20003-402
-45	210-1003-00			1	. . WASHER,FLAT:# 10	12327	OBD
-46	210-0056-00			1	. . WASHER,LOCK:SPLIT,0.047 ID X 0.32" OD,P BRZ	83385	OBD
					- - - * - - -		
-47	214-1873-00			1	. . HEAT SINK,DIODE:	80009	214-1873-00
-48	214-0579-00			2	. . TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-49	----- -----			1	. TRANSISTOR:(SEE Q3220 EPL) (ATTACHING PARTS)		
-50	211-0012-00			1	. SCREW,MACHINE:4-40 X 0.375 INCH,PNH STL	83385	OBD
-51	210-0071-00			1	. WASHER,SPR TNSN:0.146 ID X 0.323" OD,STL	78189	4706-05-01-0531
					- - - * - - -		
-52	342-0136-00			1	. INSULATOR,WSHR:0.812 OD X 0.0025 INCH THK	80009	342-0136-00
-53	----- -----			1	. CKT BD ASSY:+365/4.9V RGLRT(SEE A22 EPL) (ATTACHING PARTS)		
-54	211-0008-00			3	. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. . CKT BOARD ASSY INCLUDES:		
-55	131-0589-00			2	. . CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0608-00			9	. . CONTACT,ELEC:0.365 INCH LONG	22526	47357
-56	136-0252-04			9	. . CONTACT,ELEC:0.188 INCH LONG	22526	75060
-57	136-0269-02			1	. . SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-58	214-0579-00			2	. . TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-59	----- -----			1	. XFMR,PWR:(SEE T1310 EPL) (ATTACHING PARTS)		
-60	211-0008-00			4	. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-61	441-1162-00			1	. CHAS,DIGITIZER (ATTACHING PARTS)	80009	441-1162-00
-62	211-0507-00			2	. SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-63	----- -----			2	. CAP.,FXD,ELCTLT:(SEE C1216,1217 EPL) (ATTACHING PARTS FOR EACH)		
-64	212-0518-00			4	. SCREW,MACHINE:10-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-65	407-0964-01			1	. BRACKET,CAP:	80009	407-0964-01
-66	337-1826-00			1	. SHIELD,ELEC:LINE-INVERT,TOP (ATTACHING PARTS)	80009	337-1826-00
-67	211-0105-00			3	. SCREW,MACHINE:4-40 X 0.188"100 DEG,FLH STL	83385	OBD
-68	211-0008-00			2	. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-69	----- -----			1	. CAP.,FXD,PLASTIC:(SEE C1237 EPL) (ATTACHING PARTS)		
-70	211-0619-00			2	. SCREW MACHINE:6-32 X 1.5 INCH,FLH STL	83385	OBD
-71	386-2634-00			1	. PL,CHOKE MTG:	80009	386-2634-00
					- - - * - - -		
-72	337-1490-00			1	. SHLD,ELECTRICAL:CIRCUIT BOARD (ATTACHING PARTS)	80009	337-1490-00
-73	211-0040-00			2	. SCREW,MACHINE:4-40 X 0.25",BDCH PLSTC	26365	OBD
-74	210-0054-00			2	. WASHER,LOCK:SPLIT,0.118 ID X 0.212"OD STL	83385	OBD
					- - - * - - -		
-75	----- -----			2	. TRANSISTOR:(SEE Q1234,1241 EPL) (ATTACHING PARTS FOR EACH)		
-76	210-0586-00			2	. NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-77	386-0978-00			2	. INSULATOR,PLATE:0.002 INCH MICA,FOR TO-3	80009	386-0978-00
-78	342-0103-00			1	. INSULATOR,BLOCK: (ATTACHING PARTS)	80009	342-0103-00
-79	213-0041-00			2	. SCR,TPG,THD CTG:6-32 X 0.375 INCH,TRH STL	83385	OBD
-80	211-0512-00			1	. SCREW,MACHINE:6-32 X 0.50" 100 DEG,FLH STL	83385	OBD
-81	210-0407-00			1	. NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
					- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
3-82	214-1625-00			1	. SPRING,FLAT:2.0 INCH LONG,BOWED	80009	214-1625-00
-83	214-1871-00			1	. HEAT SINK-SHLD:	80009	214-0871-00
-84	342-0193-00			1	. INSULATOR,PLATE:	80009	342-0193-00
-85	214-1872-00			1	. HEAT SINK,DIODE:	80009	214-1872-00
					(ATTACHING PARTS)		
-86	211-0559-00			1	. SCREW,MACHINE:6-32 X 0.375"100 DEG,FLH STL	83385	OBD
-87	210-0457-00			1	. NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
-88	211-0012-00			1	. SCREW,MACHINE:4-40 X 0.375 INCH,PNH STL	83385	OBD
					- - - * - - -		
-89	220-0623-00			1	. NUT,BLOCK:	80009	220-0623-00
					(ATTACHING PARTS)		
-90	211-0504-00			1	. SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-91	----- -----			1	. CKT BOARD ASSY:PWR SPLY INV(SEE A24 EPL)		
-92	129-0323-00			2	. . POST,ELEC-MECH:HEX,0.25 X 1 INCH LONG	80009	129-0323-00
					(ATTACHING PARTS FOR EACH)		
-93	211-0097-00			1	. . SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-94	131-0591-00			7	. . CONTACT,ELEC:0.835 INCH LONG	22526	47352
-95	136-0254-01			4	. . CONTACT,ELEC:0.145 INCH LONG	00779	1-331892-8
-96	210-0406-00			1	. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
-97	361-0414-00			1	. . SPACER,DIODE:	80009	361-0414-00
-98	214-0579-00			3	. . TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-99	346-0032-00			1	. . STRAP,RETAINING:	98159	2829-75-4
-100	348-0023-00			6	. . FOOT:	02768	OBD
-101	348-0005-00			1	. . GROMMET,RUBBER:0.50 INCH DIA	70485	230
-102	355-0518-02			4	. . STUD,SELF-LKG:4-40 X 0.625 INCH LONG,BRS	80009	355-0518-02
-103	260-0336-00			1	. SW,THERMOSTATIC:SPST,8.3A AT 120 VAC	81439	36T21S-3778
					(ATTACHING PARTS)		
-104	211-0097-00			2	. SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
-105	210-0586-00			2	. NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-106	352-0326-00			1	. FUSEHOLDER:PLASTIC	80009	352-0326-00
-107	386-2618-00			1	. PL,FUSEHOLDER:	80009	386-2618-0
					(ATTACHING PARTS)		
-108	211-0507-00			2	. SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-109	210-0457-00			2	. NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		
-110	204-0374-01			1	. BODY,FUSEHOLDER:	80009	204-0374-01
-111	210-0202-00	B010100	B099999	3	. TERMINAL,LUG:SE #6	78189	2104-06-00-2520N
	210-0202-00	B100000		4	. TERMINAL,LUG:SE #6	78189	2104-06-00-2520N
					- - - * - - -		
-112	211-0507-00	B010100	B099999	2	. SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
	211-0507-00	B100000		1	. SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-113	211-0510-00	B100000		1	. SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-114	210-0407-00	B010100	B099999	2	. NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
	210-0407-00	B100000		3	. NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
					- - - * - - -		
-115	119-0420-00			1	. FILTER,RFI:	05245	6EF1
					(ATTACHING PARTS)		
-116	211-0012-00			2	. SCREW,MACHINE:4-40 X 0.375 INCH,PNH STL	83385	OBD
-117	210-0586-00			2	. NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-118	260-1300-02			1	. SWITCH,SLIDE:(SEE S1203 EPL)		
					(ATTACHING PARTS)		
-119	211-0101-00			2	. SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-120	260-1553-00			1	. SWITCH,SLIDE:(SEE S1212 EPL)		
					(ATTACHING PARTS)		
-121	211-0101-00			2	. SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-122	386-2617-00			1	. PANEL,HEATSINK:	80009	386-2617-00
-123	334-2152-00			2	. MARKER,IDENT:DANGER,W/ARROW	22670	OBD
-124	131-0707-00			75	. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
3-125	131-0945-00			5	. CONTACT,ELEC:MALE	27264	02-09-2103
-126	131-1324-00			1	. CONNECTOR,PLUG:MALE	27264	03-09-1061
-127	175-0072-00			FT	. CABLE,RF:	80009	175-0072-00
	175-0304-01			FT	. CABLE,SP,ELEC:2 COND SHIELDED 1.583 L	80009	175-0304-01
-128	175-1091-00			FT	. CABLE,SP,ELEC:4 COND SHIELDED,6.5 L	80009	175-1091-00
-129	175-1420-00			FT	. CABLE,SP,ELEC:6 COND SHIELDED,2.0 FEET L	80009	175-1420-00
-130	175-0863-00			FT	. CABLE,SP,ELEC:2 WIRE RIBBON	80009	175-0863-00
-131	175-0861-00			FT	. WIRE,ELECTRICAL:4 WIRE RIBBON	23499	TEK-175-0861-00
-132	175-0860-00			FT	. WIRE,ELECTRICAL:5 WIRE RIBBON,	23499	TEK-175-0860-00
-133	175-0859-00			FT	. WIRE,ELECTRICAL:6 WIRE RIBBON,	23499	TEK-175-0859-00
-134	175-0857-00			FT	. WIRE,ELECTRICAL:8 WIRE RIBBON	23499	TEK-175-0857-00
-135	352-0161-06			1	. CONN BODY,PL,EL:3 WIRE BLUE	80009	352-0161-06
	352-0161-07			2	. CONN BODY,PL,EL:3 WIRE VIOLET	80009	352-0161-07
-136	352-0162-04			2	. CONN BODY,PL,EL:4 WIRE YELLOW	80009	352-0162-04
	352-0162-05			2	. CONN BODY,PL,EL:4 WIRE GREEN	80009	352-0162-05
-137	352-0163-00			1	. CONN BODY,PL,EL:5 WIRE BLACK	80009	352-0163-00
	352-0163-01			1	. CONN BODY,PL,EL:5 WIRE BROWN	80009	352-0163-01
	352-0163-03			2	. CONN BODY,PL,EL:5 WIRE ORANGE	80009	352-0163-03
	352-0163-06			1	. CONN BODY,PL,EL:5 WIRE BLUE	80009	352-0163-06
-138	352-0164-02			2	. CONN BODY,PL,EL:6 WIRE RED	80009	352-0164-02
	352-0164-06			1	. CONN BODY,PL,EL:6 WIRE BLUE	80009	352-0164-06
-139	352-0166-01			2	. CONN BODY,PL,EL:8 WIRE BROWN	80009	352-0166-01
-140	352-0169-00			2	. CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0169-00
	352-0169-01			1	. CONN BODY,PL,EL:2 WIRE BROWN	80009	352-0169-01
	352-0169-08			2	. CONN BODY,PL,EL:2 WIRE GRAY	80009	352-0169-08
-141	334-2151-00			1	. MARKER,IDENT:DANGER 365V	22670	OBD

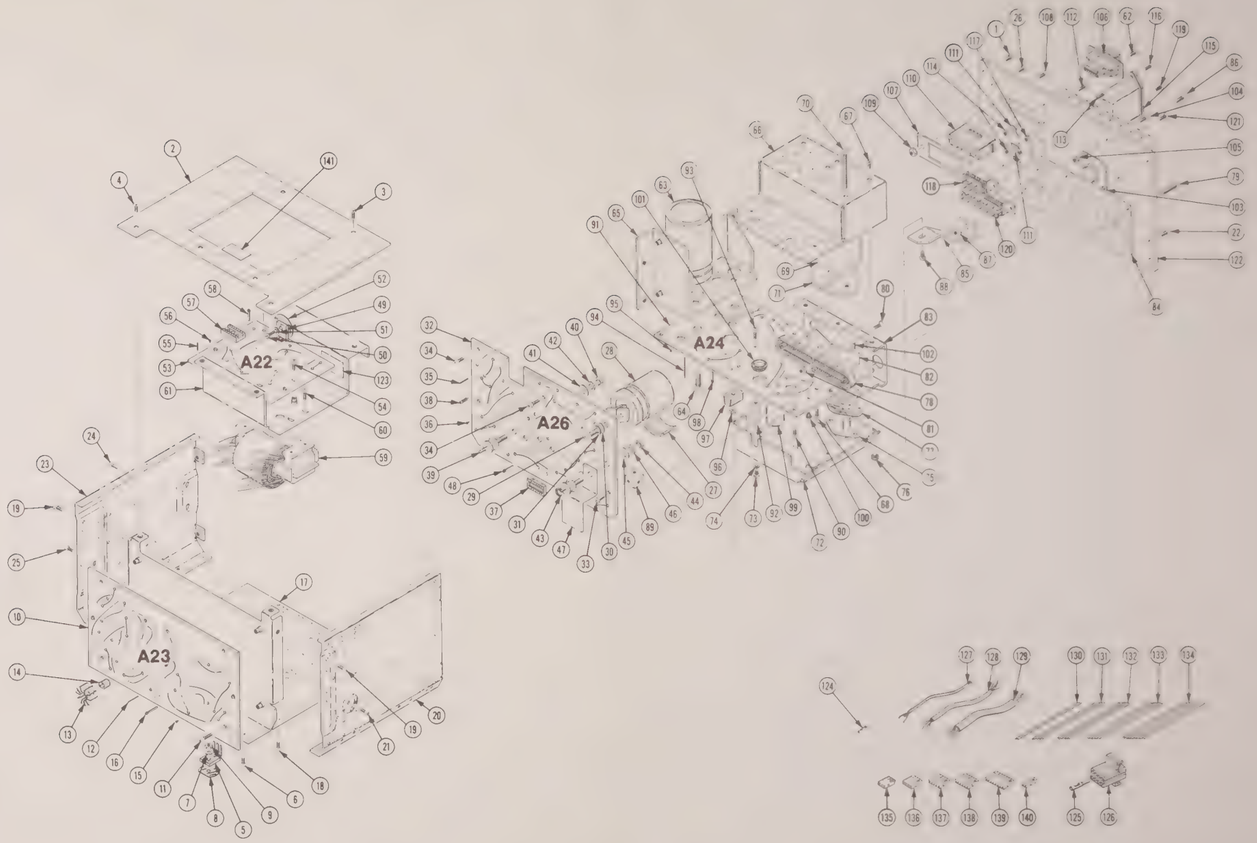

FIG. 3 POWER SUPPLY

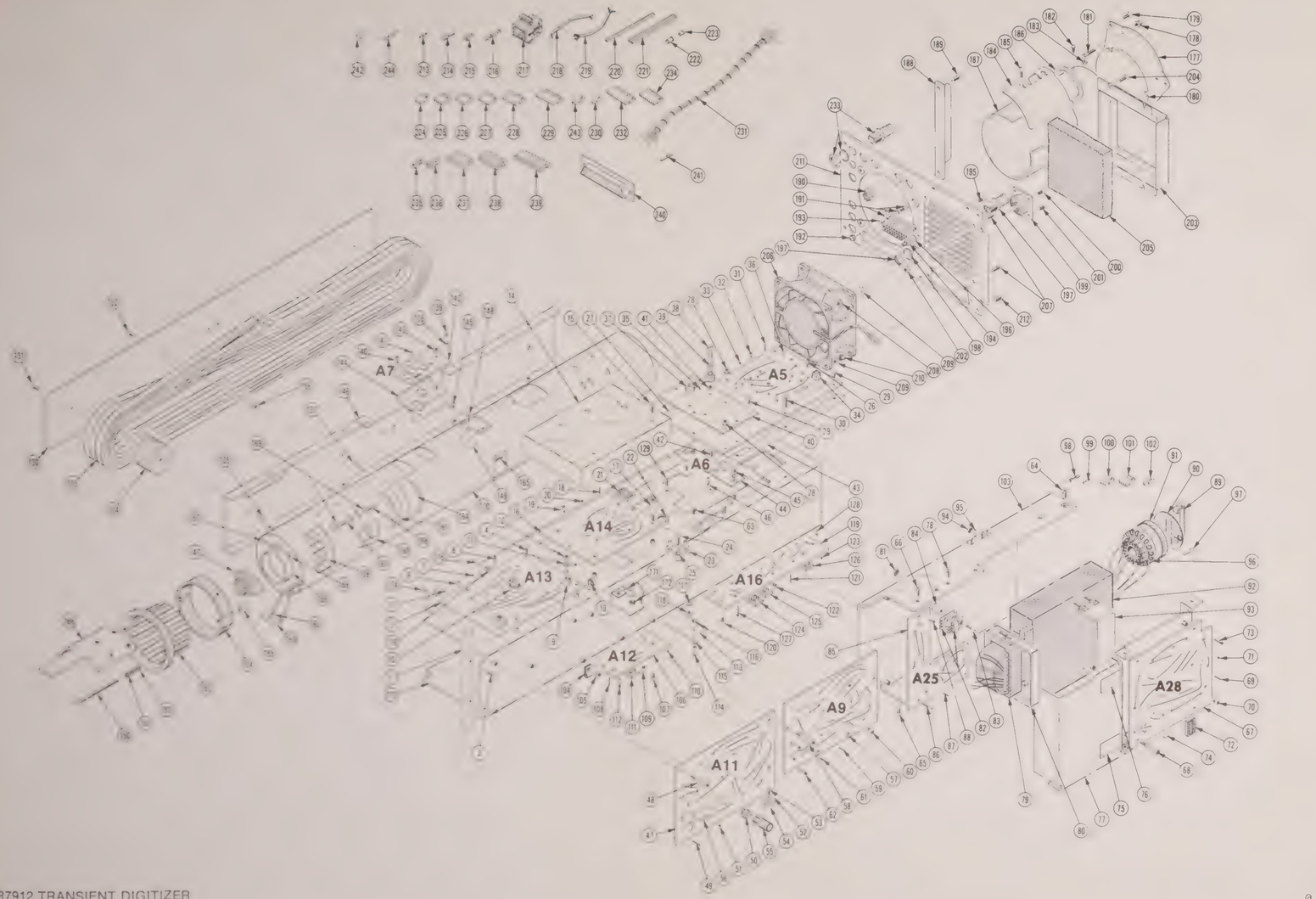

FIG. 4 U-FRAME & CRT ASSY

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
4-1	381-0342-00			1	BAR,SUPPORT:0.25 SQ X 4.92 INCH LONG	80009	381-0342-00
					(ATTACHING PARTS)		
-2	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-3	----- -----			1	CKT BOARD ASSY:READ GUN SUPPLY(SEE A14 EPL)		
					(ATTACHING PARTS)		
-4	211-0008-00			4	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-5	131-0608-00			23	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-6	131-1003-00			2	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-7	136-0252-04	B010100	B010111	46	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
	136-0252-04	B010112		40	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-8	214-0579-00			2	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-9	200-0385-00			1	. COVER,XSTR:	06090	D306-20
-10	214-1121-00			1	. HEAT SINK,ELEC:	13103	OBD
-11	210-0202-00			1	TERMINAL,LUG:SE #6	78189	2104-06-00-2520N
					(ATTACHING PARTS)		
-12	210-0406-00			1	NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
					- - - * - - -		
-13	343-0088-00	B010100	B010111	1	CLAMP,LOOP:0.062 INCH DIA	80009	343-0088-00
	343-0213-00	B010112		1	CLAMP,LOOP:PRESS MT,PLASTIC	80009	343-0213-00
-14	337-1801-00			1	SHIELD,ELEC:	80009	337-1801-00
					(ATTACHING PARTS)		
-15	211-0033-00			4	SCR,ASSEM WASH.:4-40 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-16	----- -----			1	CKT BOARD ASSY:VIDEO PREAMP(SEE A12 EPL)		
					(ATTACHNG PARTS)		
-17	129-0338-00			4	POST,ELEC-MECH:HEX.,0.188 X 0.64 INCH LONG	80009	129-0338-00
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-18	131-0608-00			8	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-19	131-1003-00			3	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-20	136-0252-04			24	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-21	136-0269-02			1	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-22	343-0089-00			1	CLAMP,LOOP:LARGE	80009	343-0089-00
-23	131-0023-00	XB020000		1	TERMINAL BOARD:	71785	1520
					(ATTACHING PARTS)		
-24	213-0146-00	XB020000		1	SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL	83385	OBD
-25	210-0006-00	XB020000		1	WASHER,LOCK:INTL,0.146 IDX 0.288 OD,STL	78189	1206-00-00-0541C
					- - - * - - -		
-26	348-0302-00			1	GROMMET,PLASTIC:FOOT BLACK	80009	348-0302-00
-27	----- -----			1	CKT BOARD ASSY:VERTICAL AMP(SEE A5 EPL)		
					(ATTACHING PARTS)		
-28	210-0586-00			3	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
-29	211-0008-00			5	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-30	211-0014-00			1	SCREW,MACHINE:4-40 X 0.50 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-31	131-0608-00			7	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-32	131-1003-00			5	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-33	136-0252-00			26	. CONTACT,ELEC:0.145 INCH LONG	00779	2-330808-7
	136-0252-04			32	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-34	136-0220-00			9	. SOCKET,PLUG-IN:3 PIN,SQUARE	71785	133-23-11-034
-35	210-0627-00			2	. RIVET,SOLID:0.042 DIA X 0.25 INCH,RDH	80009	210-0627-00
-36	210-0698-00	XB090000		1	. EYELET,METALLIC:0.047 OD X 0.62 INCH LONG	07707	S-6123
-37	343-0097-00			2	. RTNR,TRANSISTOR:HEAT SINK	80009	343-0097-00
					(ATTACHING PARTS FOR EACH)		
-38	210-0599-00			2	. NUT,SLEEVE:4-40 X 0.391 INCH LONG	80009	210-0599-00
-39	214-0368-00			1	. SPRING,HLCPS:0.24 DIA X 0.438 INCH LONG	80009	214-0368-00
					- - - * - - -		
-40	214-1683-00			1	. HEAT SINK,ELEC:TRANSISTOR	80009	214-1683-00
					(ATTACHING PARTS)		
-41	210-0551-00			4	. NUT,PLAIN,HEX.:4-40 X 0.25 INCH,STL	83385	OBD
-42	211-0097-00			4	. SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
4-43	220-0679-00			2	NUT BAR:2.25 SQ. X 6.9 LONG	80009	220-0679-00
-44	----- -----			1	CKT BOARD ASSY:VERTICAL CONN(SEE A6 EPL)		
					(ATTACHING PARTS)		
-45	129-0442-00			2	SPACER POST:0.125 L X 0.25 OD PLSTC W 4-40 THR	80009	129-0442-00
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-46	131-1558-00			2	. CONTACT,ELEC:FEMALE	91505	3545(REV 5)
-47	----- -----			1	CKT BOARD ASSY:SCAN SMP(SEE A11 EPL)		
					(ATTACHING PARTS)		
-48	129-0338-00			5	POST,ELEC-MECH:HEX.,0.188 X 0.64 INCH LONG	80009	129-0338-00
					- - - * - - -		
-49	131-0608-00			20	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-50	136-0183-00			8	. SOCKET,PLUG-IN:3 PIN,ROUND	80009	136-0183-00
-51	136-0252-04			48	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-52	200-0945-00			4	. COVER,HALF XSTR:FOR DUAL TO-18 CASE	80009	200-0945-00
					(ATTACHING PARTS FOR EACH)		
-53	211-0001-00			1	. SCREW,MACHINE:2-56 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-54	200-0945-01			4	. COVER,HALF XSTR:FOR DUAL TO-18 CS,2-56 THD	80009	200-0945-01
-55	214-0269-00			4	. HEAT SINK,ELEC:0.312 ID X 0.75 INCH LONG	98978	TXD032-075
-56	337-0763-00			1	. SHLD,ELECTRICAL:	80009	337-0763-00
-57	----- -----			1	CKT BOARD ASSY:HORIZ AMP(SEE A9 EPL)		
					(ATTACHING PARTS)		
-58	129-0338-00			4	POST,ELEC-MECH:HEX.,0.188 X 0.64 INCH LONG	80009	129-0338-00
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-59	131-0589-00			9	. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-60	131-1003-00			3	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-61	136-0252-04			48	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-62	214-0579-00			1	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
	200-0945-01			1	. COVER,HALF XSTR:FOR DUAL TO-18 CASE,2-56 THD	80009	200-0945-00
					(ATTACHING PARTS)		
	211-0001-00			1	. SCREW,MACHINE:2-56 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	200-0945-00			1	. COVER,HALF XSTR:FOR DUAL TO-18 CASE	80009	200-0945-00
	621-0472-00			1	POWER SUPPLY:HIGH VOLTAGE	80009	621-0472-00
					(ATTACHING PARTS)		
-63	210-0586-00			1	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
-64	211-0541-00			2	SCREW,MACHINE:6-32 X 0.25"100 DEG,FLH STL	83385	OBD
-65	211-0114-00			1	SCREW,MACHINE:4-40 X 0.438 INCH,FLH STL	83385	OBD
-66	211-0105-00			2	SCREW,MACHINE:4-40 X 0.188"100 DEG,FLH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. HIGH VOLTAGE POWER SUPPLY ASSY INCLUDES:		
-67	----- -----			1	. CKT BOARD ASSY:Z AXIS(SEE A28 EPL)		
					(ATTACHING PARTS)		
-68	129-0338-00			4	. POST,ELEC-MECH:HEX.,0.188 X 0.64 INCH LONG	80009	129-0338-00
					- - - * - - -		
	----- -----			-	. . CKT BOARD ASSY INCLUDES:		
-69	131-0589-00			2	. . CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0608-00			30	. . CONTACT,ELEC:0.365 INCH LONG	22526	47357
-70	131-1003-00			4	. . CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-71	136-0252-04			81	. . CONTACT,ELEC:0.188 INCH LONG	22526	75060
-72	136-0269-02			2	. . SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-73	214-0579-00			7	. . TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-74	131-0566-00			1	. . LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	0000L	ERD-18TO
-75	334-2151-00			2	. MARKER,IDENT:DANGER W/O ARROW	22670	OBD
-76	334-2152-00			1	. MARKER IDENT:DANGER W/ARROW	22670	OBD
-77	441-1153-00			1	. CHASSIS,OSCP:Z AXIS	80009	441-1153-00
					(ATTACHING PARTS)		
-78	211-0101-00			6	. SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-79	----- -----			1	. XFMR,PNR,STV:(SEE T1633 EPL)		
					(ATTACHING PARTS)		
-80	346-0010-00			1	. STRAP,TERMINAL	80009	346-0010-00
-81	210-0586-00			2	. NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-82	----- -----			2	. TRANSISTOR:(SEE Q1634,Q1636 EPL)		
					(ATTACHING PARTS FOR EACH)		
-83	211-0008-00			1	. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
4-84	129-0410-00			2	. SPACER,POST:0.375 HEX X 0.375 INCH LONG	80009	129-0410-00
-85	----- -----			1	. CKT BOARD ASSY:HIGH V OSC(SEE A25 EPL)		
					(ATTACHING PARTS)		
-86	211-0008-00			4	. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. . CKT BOARD ASSY INCLUDES:		
-87	131-0608-00			13	. . CONTACT,ELEC:0.365 INCH LONG	22526	47357
-88	136-0338-00			6	. . SOCKET,PIN TERM:	00779	1-332075-7
-89	343-0235-00			1	. CLAMP,SOCKET:	80009	343-0235-00
-90	367-0117-00			1	. PULL,SOC,PL-IN:	80009	367-0117-00
-91	200-0917-01			1	. COV,ELECTRON TU:2.052 OD X 0.291" THK,PLSTC	80009	200-0917-01
-92	119-0452-01			1	. POWER SUPPLY:(SEE A27 EPL)		
					(ATTACHING PARTS)		
-93	346-0099-00			1	. BAND,RETAINING:	80009	346-0099-00
-94	210-0589-00			4	. NUT,SELF LKG HE:4-40 X 0.250 INCH	13257	22 NM-40
-95	210-1092-00			4	. WASHER,FLAT:0.147 ID X 0.312" OD,BRS	12327	OBD
					- - - * - - -		
	----- -----			-	. . POWER SUPPLY INCLUDES:		
	136-0304-02			1	. . SOCKET,PLUG-IN:CRT,14 PIN SOCKET,W/PINS	80009	136-0304-02
-96	214-0464-00			14	. . . CONTACT,ELEC:CRT	80009	214-0464-00
-97	204-0355-01			1	. . . BODY,CRT SOCKET:	80009	204-0355-01
-98	131-0512-02			2	. . . CONTACT,ELEC:0.315 INCH LONG	00779	61491-1
-99	131-0707-00			9	. . CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
	131-0708-00			1	. . CONTACT,ELEC:0.48"L,28-32 AWG WIRE	22526	47437
-100	352-0161-00			1	. . CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0161-00
	352-0161-01			1	. . CONN BODY,PL,EL:3 WIRE BROWN	80009	352-0161-01
-101	352-0162-03			1	. . CONN BODY,PL,EL:4 WIRE ORANGE	80009	352-0162-03
-102	352-0171-02			1	. . CONN BODY,PL,EL:1 WIRE RED	80009	352-0171-02
-103	441-1152-00			1	. CHASSIS,SCOPE:	80009	441-1152-00
-104	343-0144-00			1	CLAMP,LOOP:0.125 INCH ID,BLK NYLON	95987	1-8-2
					(ATTACHING PARTS)		
-105	210-0586-00			1	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-106	----- -----			1	CKT BOARD ASSY:RD GUN CATH RGLTR(SEE A13 EPL)		
					(ATTACHING PARTS)		
-107	211-0008-00			4	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-108	131-0608-00			23	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-109	131-1003-00			2	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-110	136-0252-04			34	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-111	136-0269-02			1	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-112	214-0579-00			6	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-113	----- -----			1	RES.,FXD,FILM:(SEE R782A,B EPL)		
					(ATTACHING PARTS)		
-114	210-0599-00			2	NUT,SLEEVE:4-40 X 0.391 INCH LONG	80009	210-0599-00
-115	210-0802-00			2	WASHER,FLAT:0.15 ID X 0.312 INCH OD	12327	OBD
-116	166-0107-00			2	SPACER,SLEEVE:0.18 ID X 0.25 INCH LONG	80009	166-0107-00
					- - - * - - -		
-117	210-0202-00			1	TERMINAL,LUG:SE #6	78189	2104-06-00-2520N
					(ATTACHING PARTS)		
-118	210-0407-00			1	NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
					- - - * - - -		
-119	----- -----			1	CKT BOARD ASSY:VIDEO PROFESSOR(SEE A16 EPL)		
					(ATTACHING PARTS)		
-120	211-0008-00			4	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-121	131-0608-00			17	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-122	131-1003-00			8	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-123	136-0252-04			70	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-124	136-0260-02			2	. SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
-125	136-0269-02			4	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
4-126	136-0514-00			2	. SOCKET,PLUG-IN:MICROCIRCUIT,8 CONTACT	82647	C930802
-127	214-0579-00			8	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-128	386-1556-00			2	. SPACER,CKT BD:0.215 BD HT,PLASTIC	80009	386-1556-00
	260-0723-00	B010100	B010111X	1	. SWITCH,SLIDE:DPDT,0.5A,125VAC	79727	GF126-0028
	119-0437-00			1	DELAY LINE,ELEC:	80009	119-0437-00
					(ATTACHING PARTS)		
-129	211-0101-00			8	SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. DELAY LINE INCLUDES:		
-130	441-1154-00			1	. CHAS,DELAY LINE:RIGHT	80009	441-1154-00
					(ATTACHING PARTS)		
-131	213-0068-00			2	. SCR,TPG,THD CTG:4-40 X 0.50 INCH,PNL STL	83385	OBD
-132	211-0101-00			2	. SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-133	175-1309-00			FT	. CABLE,RF:	80009	175-1309-00
-134	129-0403-00			2	. SPACER,POST:1.5 DIA X 1.45 INCH LONG	80009	129-0403-00
					(ATTACHING PARTS FOR EACH)		
-135	213-0068-00			1	. SCR,TPG,THD CTG:4-40 X 0.50 INCH,PNL STL	83385	OBD
					- - - * - - -		
-136	129-0425-00			2	. SPACER,POST:0.90 L X 0.25 HEX	80009	129-0425-00
					(ATTACHING PARTS FOR EACH)		
-137	211-0101-00			1	. SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-138	210-0774-00			8	. EYELET,METALLIC:0.152 OD X 0.245 INCH L,BRS	80009	210-0774-00
-139	210-0775-00			8	. EYELET,METALLIC:0.126 OD X 0.23 INCH L,BRS	80009	210-0775-00
-140	131-1003-00			4	. CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-141	136-0252-04			4	. . CONTACT,ELEC:0.188 INCH LONG	22526	75060
-142	----- -----			1	. CKT BOARD ASSY:DELAY LINE TERM(SEE A7 EPL)		
					(ATTACHING PARTS)		
-143	210-0586-00			1	. NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-144	407-1310-00			1	. BRACKET,DL:	80009	407-1310-00
					(ATTACHING PARTS)		
-145	210-0586-00			2	. NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-146	441-1155-00			1	. CHASSIS,SCOPE:	80009	441-1155-00
-147	136-0120-01			1	SKT,PL-IN ELEK:	80009	136-0120-01
	154-0698-00			1	ELECTRON TUBE:ASSEMBLY	80009	154-0698-00
					(ATTACHING PARTS)		
-148	211-0117-00			11	SCREW,MACHINE:4-40 X 0.312 INCH,PNH,SST	70318	OBD
-149	386-2767-00			3	PLATE,GND,CRT:	80009	386-2767-00
					- - - * - - -		
	----- -----			-	. CATHODE RAY TUBE ASSY INCLUDES:		
-150	211-0170-00			4	. SCREW,MACHINE:4-40 X 2.75 INCH,PNH STL	83385	OBD
-151	214-1333-00			4	. SPRING,HLCPS:0.213 OD X 0.375 INCH LONG	80009	214-1333-00
-152	210-0994-00			4	. WASHER,FLAT:0.125 ID X 0.25" OD,STL	83385	OBD
-153	343-0205-03			2	. CLP,ELCTRN TUBE:	80009	343-0205-03
-154	354-0347-00			2	. RING,CLP,CRT RE:	80009	354-0347-00
-155	384-0617-00			2	. SPACER POST:0.25 HEX X 0.275 INCH LONG	80009	384-0617-00
-156	343-0442-00			1	. CLAMP,COIL:	80009	343-0442-00
					(ATTACHING PARTS)		
-157	211-0152-00			1	. SCR,ASSEM WSHR:4-40 X 0.625 INCH,PNH BRS	83385	OBD
-158	210-0406-00			1	. NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
					- - - * - - -		
-159	108-0763-00			1	. COIL,RF:X-Y ALIGNMENT	80009	108-0763-00
					(ATTACHING PARTS)		
-160	211-0105-00			1	. SCREW,MACHINE:4-40 X 0.188"100 DEG,FLH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. . COIL ALIGNMENT INCLUDES:		
	131-0707-00			3	. . CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
	352-0161-05			1	. . CONN BODY,PL,EL:3 WIRE GREEN	80009	352-0161-05
	386-2505-00			1	. . SPRT,COIL FORM:	80009	386-2505-00
	337-2019-00			1	. . SHIELD,ELEC:	80009	337-2019-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
4-161	343-0441-00			1	. RETANER,COIL:	80009	343-0441-00
-162	352-0161-00			1	. CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0161-00
-163	352-0169-06			1	. CONN BODY,PL,EL:2 WIRE BLUE	80009	352-0169-06
-164	108-0764-00			1	. COIL,RF:FOCUS	80009	108-0764-00
	----- -----			-	. . COIL FIXED FUCUS INCLUDES:		
	131-0707-00			5	. . CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-165	124-0050-00			IN	. PLASTIC STRIP:0.75W X 9.875" LG,FOAM TAPE	80009	124-0050-00
-166	386-2757-00			4	. SUPPORT,SHIELD:	80009	386-2757-00
					(ATTACHING PARTS FOR EACH)		
-167	211-0168-00			4	. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	12360	OBD
-168	211-0596-00			2	. SCREW,MACHINE:6-32 X 0.375 INCH,PNH BRS	83385	OBD
-169	210-0802-00			6	. WASHER,FLAT:0.15 ID X 0.312 INCH OD	12327	OBD
					- - - * - - -		
-170	337-1798-00			1	. SHIELD:ELEC:	80009	337-1798-00
-171	124-0291-00			1	TERMINAL BOARD:		
					(ATTACHING PARTS)		
-172	210-0407-00			1	NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
					- - - * - - -		
-173	441-1163-00			1	CHAS,TRANSIENT:MAIN	80009	441-1163-00
					(ATTACHING PARTS)		
-174	211-0503-00			2	SCREW,MACHINE:6-32 X 0.125 INCH,PNH STL	83385	OBD
-175	211-0507-00			8	SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-176	210-0457-00			8	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		
-177	200-1528-00			1	COVER ACCESS	80009	200-1528-00
					(ATTACHING PARTS)		
-178	220-0601-00			3	NUT,PLAIN,CAP:4-40 X 0.25 INCH HEX,BRS	73743	3261-0718
-179	211-0008-00			3	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-180	337-1846-00			1	SHIELD,ELEC:	80009	337-1846-00
-181	214-0034-00			3	BOLT,EYE:	79251	A24F4-1068
					(ATTACHING PARTS)		
-182	211-0022-00			3	SCREW,MACHINE:2-56 X 0.188 INCH,PNH STL	83385	OBD
-183	210-0405-00			3	NUT,PLAIN,HEX.:2-56 X 0.188 INCH,BRS	73743	2X12157-402
					- - - * - - -		
-184	337-1916-00			1	SHIELD,ELEC:	80009	337-1916-00
					(ATTACHING PARTS)		
-185	211-0168-00			2	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	12360	OBD
					- - - * - - -		
-186	252-0562-00			FT	PLASTIC CHANNEL:0.300 L	06229	OBD
-187	337-1828-00			1	SHIELD,CRT:	80009	337-1828-00
-188	348-0361-00			1	FOOT,CABINET:	80009	348-0361-00
					(ATTACHING PARTS)		
-189	211-0504-00			2	SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-190	134-0026-00			5	BUTTON,PLUG:	72653	1711
-191	131-1278-00			1	SHLD,ELEC CONN:50 SOCKET	00779	205211-1
					(ATTACHING PARTS)		
-192	131-0890-00			2	LOCK,CONNECTOR:4-40 X 0.312 L	71468	D 20418-2
-193	210-1002-00			2	WASHER,FLAT:0.125 ID X 0.25 INCH OD,BRS	12327	OBD
					- - - * - - -		
-194	131-0809-00			1	TERMINAL,STUD:PNL MT,4-40 TAP 1 END	71279	1510-1-05.19
					(ATTACHING PARTS)		
-195	211-0007-00			1	SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL	83385	OBD
-196	210-1002-00			1	WASHER,FLAT:0.125 ID X 0.25 INCH OD,BRS	12327	OBD
					- - - * - - -		
-197	131-0955-00			1	CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
-198	210-0255-00			1	TERMINAL,LUG:0.391" ID INT TOOTH	80009	210-0255-00
-199	136-0089-00			1	CONNECTOR,RCPT,:9 PIN CHASSISMOUNT	02660	165-16
					(ATTACHING PARTS)		
-200	211-0097-00			2	SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
-201	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-202	210-0586-00			2	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
4-203	380-0308-00			1		HOUSING,FILTER:AP	80009	380-0308-00
						(ATTACHING PARTS)		
-204	211-0510-00			4		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
-205	378-0045-01			1		FILTER,ELEM,AIR:	80009	378-0045-01
-206	119-0215-04			1		FAN,TUBE AXIAL:	80009	119-0215-04
						(ATTACHING PARTS)		
-207	211-0510-00	B010100	B130456	4		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
	211-0511-00	B130457		4		SCREW,MACHINE:6-32 X 0.50 INCH,PNH STL	83385	OBD
-208	210-0457-00			3		NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
-209	210-0407-00	B010100	B130456	1		NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
	210-0407-00	B130457		5		NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
						- - - * - - -		
-210	210-0202-00			1		TERMINAL,LUG:SE #6	78189	2104-06-00-2520N
-211	386-2556-00			1		SUBPANEL,REAR:	80009	386-2556-00
						(ATTACHING PARTS)		
-212	211-0504-00			2		SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
-213	131-0707-00	B010100	B089999	39		CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
	131-0707-00	B090000		45		CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-214	131-0948-00			5		CONTACT,ELEC:FEMALE	27264	02-09-1103
-215	131-0965-00			3		CONTACT,ELEC:0.25" SQ,22-26 AWG WIRE	80009	131-0965-00
-216	131-1279-01			6		CONTACT,ELEC:FEMALE	00779	205311-4
-217	131-1323-00			1		CONNECTOR,PLUG:FEMALE	27264	03-09-2062
-218	175-0072-00			FT		CABLE,RF:	80009	175-0072-00
-219	175-0076-00			FT		CABLE,SP,ELEC:COAX,3 COND,W/BRAID	80009	175-0076-00
-220	175-0825-00			FT		WIRE,ELECTRICAL:2 WIRE RIBBON	23499	TEK-175-0825-00
-221	175-0827-00			FT		WIRE,ELECTRICAL:4 WIRE RIBBON	08261	TEK-175-0827-00
-222	210-0774-00			10		EYELET,METALLIC:0.152 OD X 0.245 INCH L,BRS	80009	210-0774-00
-223	210-0775-00			10		EYELET,METALLIC:0.126 OD X 0.23 INCH L,BRS	80009	210-0775-00
-224	352-0161-00			2		CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0161-00
	352-0161-02			1		CONN BODY,PL,EL:3 WIRE RED	80009	352-0161-02
	352-0161-03			1		CONN BODY,PL,EL:3 WIRE ORANGE	80009	352-0161-03
-225	352-0162-00			1		CONN BODY,PL,EL:4 WIRE BLACK	80009	352-0162-00
	352-0162-08	B010100	B089999	2		HOLDER,TERM.CON:4 WIRE GRAY	80009	352-0162-08
	352-0162-08	B090000		3		HOLDER,TERM.CON:4 WIRE GRAY	80009	352-0162-08
-226	352-0163-02			1		CONN BODY,PL,EL:5 WIRE RED	80009	352-0163-02
-227	352-0164-03			1		CONN BODY,PL,EL:6 WIRE ORANGE	80009	352-0164-03
-228	352-0165-00			1		CONN BODY,PL,EL:7 WIRE BLACK	80009	352-0165-00
-229	352-0167-08	B010100	B089999	2		CONN BODY,PL EL:9 WIRE GRAY	80009	352-0167-08
	352-0167-08	B090000		3		CONN BODY,PL EL:9 WIRE GRAY	80009	352-0167-08
-230	352-0171-00			1		CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0171-00
-231	179-2022-00			1		WIRING HARNESS:COAX	80009	179-2022-00
	131-0707-00			31		. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
	131-0708-00			24		. CONTACT,ELEC:0.48"L,28-32 AWG WIRE	22526	47437
	131-1279-01			13		. CONTACT,ELEC:FEMALE	00779	205311-4
	175-0072-00			FT		CABLE,RF:	80009	175-0072-00
	210-0774-00			56		. EYELET,METALLIC:0.152 OD X 0.245 INCH L,BRS	80009	210-0774-00
	210-0775-00			56		. EYELET,METALLIC:0.126 OD X 0.23 INCH L,BRS	80009	210-0775-00
	352-0162-00			2		. CONN BODY,PL,EL:4 WIRE BLACK	80009	352-0162-00
	352-0162-05			1		. CONN BODY,PL,EL:4 WIRE GREEN	80009	352-0162-05
	352-0163-01			1		. CONN BODY,PL,EL:5 WIRE BROWN	80009	352-0163-01
	352-0163-05			1		. CONN BODY,PL,EL:5 WIRE GREEN	80009	352-0163-05
	352-0164-00			2		. CONN BODY,PL,EL:6 WIRE BLACK	80009	352-0164-00
	352-0167-02			1		. CONN BODY,PL,EL:9 WIRE RED	80009	352-0167-02
-232	352-0168-00			1		. CONN BODY,PL,EL:10 WIRE BLACK	80009	352-0168-00
	352-0169-00			1		. CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0169-00
	352-0169-02			2		. CONN BODY,PL,EL:2 WIRE RED	80009	352-0169-00
	352-0169-03			1		. CONN BODY,PL,EL:2 WIRE ORANGE	80009	352-0169-03
	352-0171-00			1		. CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0171-00
	179-2023-00			1		WIRING HARNESS:MAIN	80009	179-2023-00
	131-0621-00			6		. CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	46231
	131-0707-00			322		. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
4-	131-0708-00			8	. CONTACT,ELEC:0.48"L,28-32 AWG WIRE	22526	47437
	131-0792-00			27	. CONTACT,ELEC:0.577"L,18-20 AWG WIRE	22526	46221
-233	131-0818-00			1	. CONNECTOR,RCPT,:BNC,FEMALE	91836	KC19-153BNC
	131-1279-01			26	. CONTACT,ELEC:FEMALE	00779	205311-4
	210-0774-00			4	. EYELET,METALLIC:0.152 OD X 0.245 INCH L,BRS	80009	210-0774-00
	210-0775-00			4	. EYELET,METALLIC:0.126 OD X 0.23 INCH L,BRS	80009	210-0775-00
	352-0161-00			4	. CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0161-00
	352-0162-08			1	. HOLDER,TERM.CON:4 WIRE GRAY	80009	352-0162-08
	352-0163-01			2	. CONN BODY,PL,EL:5 WIRE BROWN	80009	352-0163-01
	352-0163-03			1	. CONN BODY,PL,EL:5 WIRE ORANGE	80009	352-0163-03
	352-0163-06			1	. CONN BODY,PL,EL:5 WIRE BLUE	80009	352-0163-06
	352-0164-00			1	. CONN BODY,PL,EL:6 WIRE BLACK	80009	352-0164-00
	352-0164-04			2	. CONN BODY,PL,EL:6 WIRE YELLOW	80009	352-0164-04
	352-0164-06			1	. CONN BODY,PL,EL:6 WIRE BLUE	80009	352-0164-06
	352-0165-00			5	. CONN BODY,PL,EL:7 WIRE BLACK	80009	352-0165-00
	352-0165-01			2	. CONN BODY,PL,EL:7 WIRE BROWN	80009	352-0165-01
	352-0165-04			1	. CONN BODY,PL,EL:7 WIRE YELLOW	80009	352-0165-04
-234	352-0166-00			1	. CONN BODY,PL,EL:8 WIRE BLACK	80009	352-0166-00
	352-0167-00			1	. CONN BODY,PL,EL:9 WIRE BLACK	80009	352-0167-00
	352-0167-01			2	. HOLDER,TERM.CON:9 WIRE BROWN	80009	352-0167-01
	352-0167-02			2	. CONN BODY,PL,EL:9 WIRE RED	80009	352-0167-02
	352-0167-03			3	. HOLDER,TERM,CON:9 WIRE ORANGE	80009	352-0167-03
	352-0167-04			1	. CONN BODY,PL,EL:9 WIRE YELLOW	80009	352-0167-04
	352-0167-05			2	. CONN BODY,PL,EL:9 WIRE GREEN	80009	352-0167-05
	352-0167-06			2	. CONN BODY,PL,EL:8 WIRE BLUE	80009	352-0167-06
	352-0167-07			2	. HOLDER,TERM.CON:9 WIRE VIOLET	80009	352-0167-07
	352-0167-08			1	. CONN BODY,PL EL:9 WIRE GRAY	80009	352-0167-08
	352-0167-09			3	. CONN BODY,PL,EL:9 WIRE WHITE	80009	352-0167-09
	352-0168-00			1	. CONN BODY,PL,EL:10 WIRE BLACK	80009	352-0168-00
	352-0168-03			2	. CONN BODY,PL,EL:10 WIRE ORANGE	80009	352-0168-03
	352-0168-09			2	. CONN BODY,PL,EL:10 WIRE WHITE	80009	352-0168-09
	352-0169-00			12	. CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0169-00
	352-0169-02			2	. CONN BODY,PL,EL:2 WIRE RED	80009	352-0169-00
	352-0169-05			1	. CONN BODY,PL,EL:2 WIRE,GREEN	80009	352-0169-05
	352-0171-00			2	. CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0171-00
-235	352-0197-00			1	. CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0197-00
-236	352-0198-00			2	. CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0198-00
	352-0198-01			1	. HOLDER,TERM.CON:2 WIRE BROWN	80009	352-0198-01
-237	352-0202-00			1	. CONN BODY,PL,EL:6 WIRE BLACK	80009	352-0202-00
-238	352-0203-03			1	. HOLDER,TERM.CON:7 WIRE ORANGE	80009	352-0203-03
-239	352-0205-00			1	. CONN BODY,PL,EL:9 WIRE BLACK	80009	352-0205-00
	352-0205-01			1	. CONN BODY,PL,EL:9 WIRE BROWN	80009	352-0205-01
	179-2024-00			1	WIRING HARNESS:REAR PANEL	80009	179-2024-00
	131-0707-00			2	. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
	131-0708-00			2	. CONTACT,ELEC:0.48"L,28-32 AWG WIRE	22526	47437
	131-0818-00			4	. CONNECTOR,RCPT,:BNC,FEMALE	91836	KC19-153BNC
	131-1279-01			2	. CONTACT,ELEC:FEMALE	00779	205311-4
	210-0774-00			3	. EYELET,METALLIC:0.152 OD X 0.245 INCH L,BRS	80009	210-0774-00
	210-0775-00			3	. EYELET,METALLIC:0.126 OD X 0.23 INCH L,BRS	80009	210-0775-00
	179-2025-00			1	WIRING HARNESS:DATA INTERCONNECT	80009	179-2025-00
	131-0707-00			62	. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
	131-0818-00			2	. CONNECTOR,RCPT,:BNC,FEMALE	91836	KC19-153BNC
-240	131-1405-00			1	. CONN BODY,PLUG:104 SOCKET	00779	204510-1
-241	131-1407-00			87	. CONTACT,ELEC:FEMALE	00779	204351-1
-242	210-0247-00			1	. TERMINAL,LUG:SOLDERLESS W/#10 HOLE	59730	C26
	352-0164-02			1	. CONN BODY,PL,EL:6 WIRE RED	80009	352-0164-02
	352-0164-04			1	. CONN BODY,PL,EL:6 WIRE YELLOW	80009	352-0164-04
	352-0166-04			1	. CONN BODY,PL,EL:8 WIRE YELLOW	80009	352-0166-04
	352-0168-03			1	. CONN BODY,PL,EL:10 WIRE ORANGE	80009	352-0168-03
	352-0168-04			1	. CONN BODY,PL,EL:10 WIRE YELLOW	80009	352-0168-04

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
4-	352-0168-05			1	. CONN BODY,PL,EL:10 WIRE GREEN	80009	352-0168-05
	352-0168-06			1	. CONN BODY,PL,EL:10 WIRE BLUE	80009	352-0168-06
-243	352-0169-04			1	. CONN BODY,PL,EL:2 WIRE YELLOW	80009	352-0169-04
	179-2026-00	B011000	B019999	1	WIRING HARNESS:CRT	80009	179-2026-00
	179-2026-01			1	WIRING HARNESS:CRT	80009	179-2026-01
	131-0707-00			5	. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-244	131-1538-00	B010100	B019999	1	. CONTACT,ELEC:CRIMP-ON,22-26 AWG WIRE	22526	75369-002
	131-1538-00	B020000		2	. CONTACT,ELEC:CRIMP-ON,22-26 AWG WIRE	22526	75369-002
	195-0112-00			1	LEAD SET,ELEC:CRT DEFLECTION	80009	195-0122-00
	131-1538-00			7	. CONTACT,ELEC:CRIMP-ON,22-26 AWG WIRE	22526	75369-002

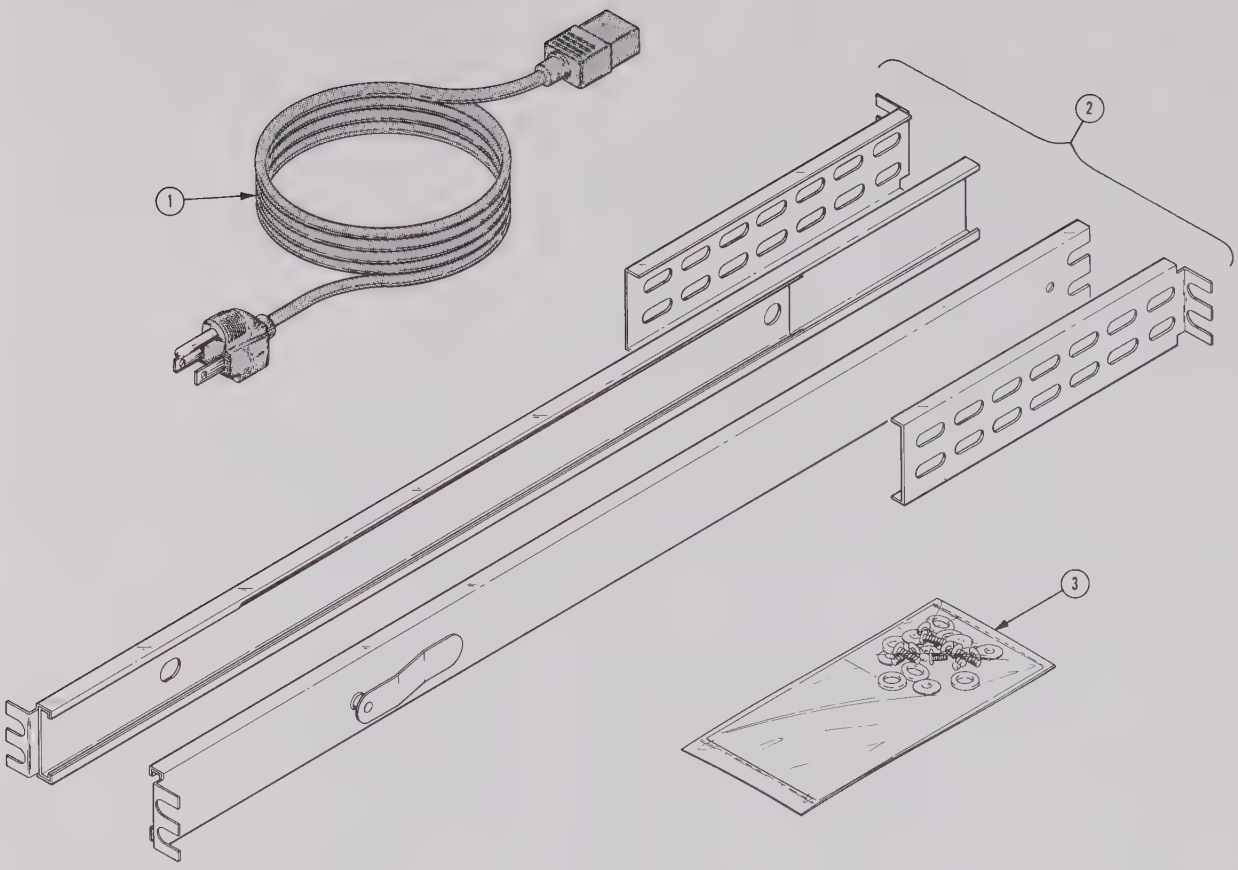

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
-1	161-0066-00			1	CABLE ASSY,PWR:3 WIRE,98 INCHES LONG	80009	161-0066-00
-2	351-0375-00			PR	GUIDE,SLIDE:LEFT AND RIGHT HAND,24" LONG	80009	351-0375-00
-3	016-0131-00			1	HDW KIT,ELEK EQ:	80009	016-0131-00
	070-1589-00			1	MANUAL,TECH:OPERATORS	80009	070-1589-00
	070-1590-00			1	MANUAL,TECH:INSTRUCTION	80009	070-1590-00

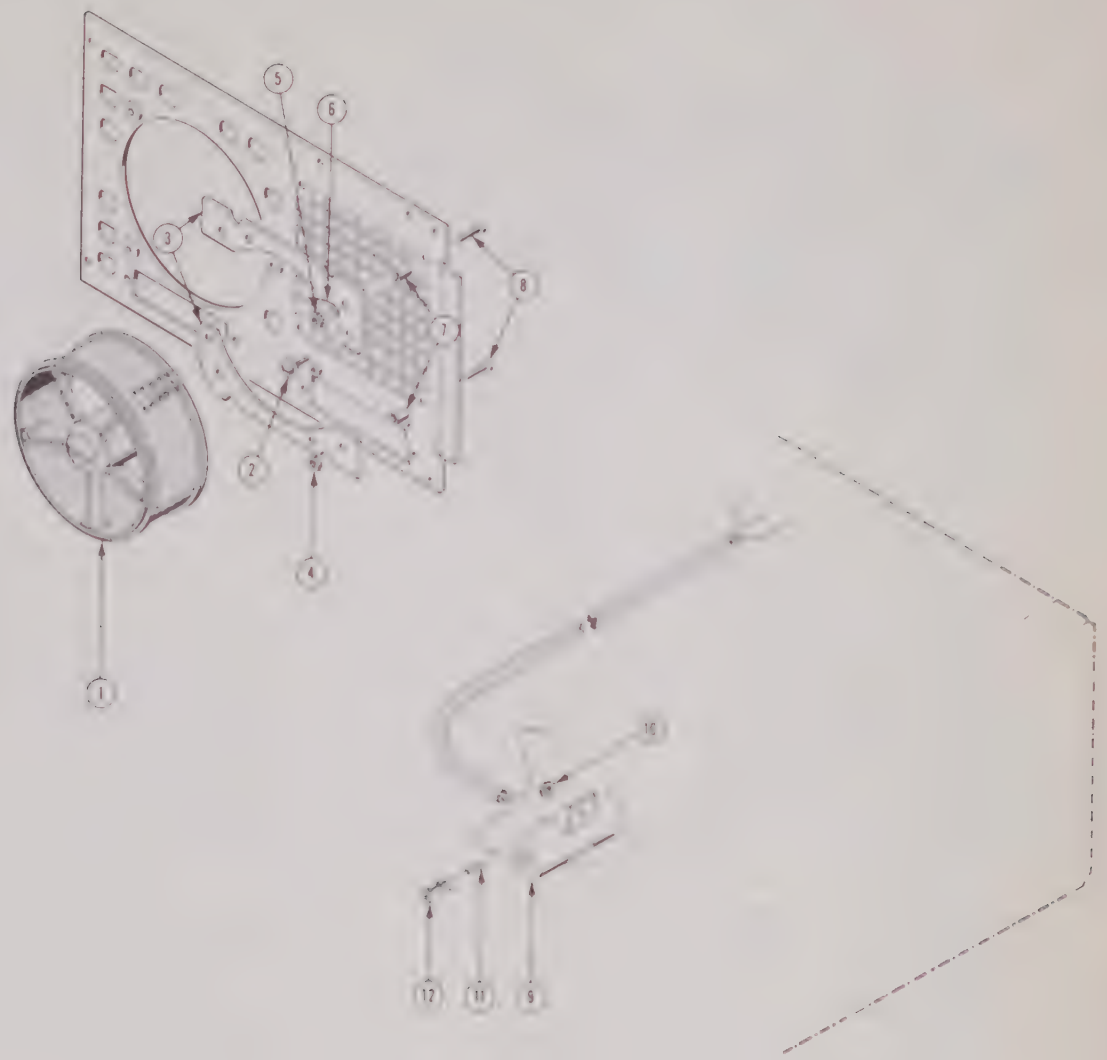

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
-1	----- -----			1	FAN AXIAL:115V,400HZ,41W,122CFM(SEE B1204 EPL)		
					(ATTACHING PARTS)		
-2	343-0477-00			4	CLAMP,LOOP:	80009	343-0477-00
					- - - * - - -		
-3	386-2667-00			2	SUPPORT,FAN:	80009	386-2667-00
					(ATTACHING PARTS)		
-4	210-0457-00			3	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
-5	210-0407-00			1	NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
-6	210-0202-00			1	TERMINAL,LUG:SE #6	78189	2104-06-00-2520N
-7	361-0060-00			4	NUT,PLAIN,HEX.:6-32 X 0.175 INCH LONG	80009	361-0060-00
-8	211-0511-00			4	SCREW,MACHINE:6-32 X 0.50 INCH,PNH STL	83385	OBD
					- - - * - - -		
-9	----- -----			1	CAP.,FXD,PLSTC:0.68UF,20%,320V(SEE C1204 EPL)		
					(ATTACHING PARTS)		
-10	210-0586-00			1	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-11	131-0792-00			2	CONTACT,ELEC:0.577"L,18-20 AWG WIRE	22526	46221
-12	352-0197-00			2	CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0197-00

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

SERVICE NOTE

Because of the universal parts procurement problem, some electrical parts in your instrument may be different from those described in the Replaceable Electrical Parts List. The parts used will in no way alter or compromise the performance or reliability of this instrument. They are installed when necessary to ensure prompt delivery to the customer. Order replacement parts from the Replaceable Electrical Parts List.

CALIBRATION TEST EQUIPMENT REPLACEMENT

Calibration Test Equipment Chart

This chart compares TM 500 product performance to that of older Tektronix equipment. Only those characteristics where significant specification differences occur are listed. In some cases the new instrument may not be a total functional replacement. Additional support instrumentation may be needed or a change in calibration procedure may be necessary.

Comparison of Main Characteristics

DM 501 replaces 7D13		
PG 501 replaces 107	PG 501 - Risetime less than 3.5 ns into 50 Ω	107 - Risetime less than 3.0 ns into 50 Ω
108	PG 501 - 5 V output pulse; 3.5 ns Risetime	108 - 10 V output pulse, 1 ns Risetime.
111	PG 501 - Risetime less than 3.5 ns, 8 ns Pretrigger pulse delay	111 - Risetime 0.5 ns, 30 to 250 ns Pretrigger Pulse delay
114	PG 501 - ±5 V output	114 - ±10 V output. Short proof output.
115	PG 501 - Does not have Paired, Burst, Gated, or Delayed pulse mode. ±5 V dc Offset. Has ±5 V output	115 - Paired, Burst, Gated, and Delayed pulse mode, ±10 V output Short-proof output.
PG 502 replaces 107		
108	PG 502 - 5 V output	108 - 10 V output
111	PG 502 - Risetime less than 1 ns; 10 ns Pretrigger pulse delay	111 - Risetime 0.5 ns, 30 to 250 ns Pretrigger pulse delay
114	PG 502 - ±5 V output	114 - ±10 V output. Short proof output.
115	PG 502 - Does not have Paired, Burst, Gated, Delayed & Undelayed pulse mode. Has ±5 V output	115 - Paired, Burst, Gated, Delayed & Undelayed pulse mode, ±10 V output Short-proof output
2101	PG 502 - Does not have Paired or Delayed pulse. Has ±5 V output	2101 - Paired and Delayed pulse, 10 V output.
PG 506 replaces 106	PG 506 - Positive-going trigger output signal at least 1 V; High Amplitude output, 60 V.	106 - Positive and Negative-going trigger output signal, 50 ns and 1 V; High Amplitude output, 100 V.
067-0502-01	PG 506 - Does not have chopped feature	0502-01 - Comparator output can be alternately chopped to a reference voltage
SG 503 replaces 190, 190A, 190B	SG 503 - Amplitude range 5 mV to 5.5 V p-p.	190B - Amplitude range 40 mV to 10 V p-p.
191	SG 503 - Frequency range 250 kHz to 250 MHz.	191 - Frequency range 350 kHz to 100 MHz.
067-0532-01	SG 503 - Frequency range 250 kHz to 250 MHz	0532-01 - Frequency range 65 MHz to 500 MHz.
TG 501 replaces 180, 180A	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	180A - Marker outputs, 5 sec to 1 μs. Sinewave available at 20, 10, and 2 ns. Trigger pulses 1, 10, 100 Hz, 1, 10, and 100 kHz Multiple time-marks can be generated simultaneously.
181	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns.	181 - Marker outputs, 1, 10, 100, 1000, and 10,000 μs, plus 10 ns sinewave.
184	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	184 - Marker outputs, 5 sec to 2 ns. Sinewave available at 50, 20, 10, 5, and 2 ns. Separate trigger pulses of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 μs. Marker amplifier provides positive or negative time marks of 25 V min. Marker intervals of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 μs.
2901	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	2901 - Marker outputs, 5 sec to 0.1 μs. Sinewave available to 50, 10, and 5 ns. Separate trigger pulses, from 5 sec to 0.1 μs. Multiple time-marks can be generated simultaneously.

NOTE: All TM 500 generator outputs are short-proof. All TM 500 plug-in instruments require TM 500-Series Power Module.

MANUAL CHANGE INFORMATION

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PRODUCT R7912 Service
070-1590-00

CHANGE REFERENCE M25,014 &
DATE 9-29-76 M30,608

CHANGE:	DESCRIPTION

EFF SN B220900-up

TEXT CORRECTION

Page 6-56 Step 32.d

CHANGE TO READ:

"roughly adjust R730 and R4619 on the Vertical Amplifier Board".

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

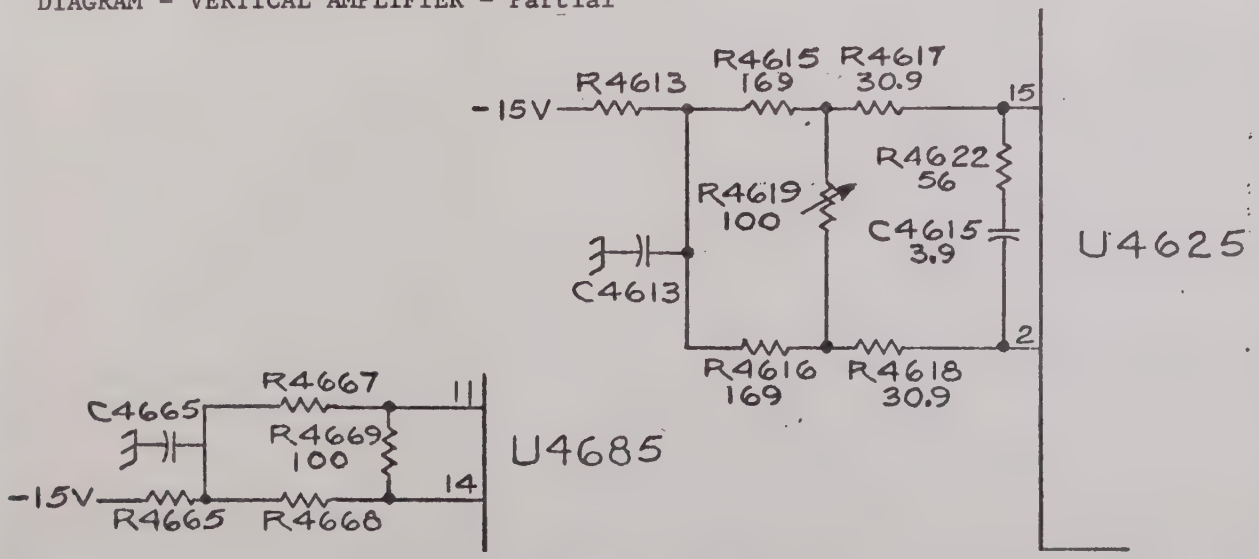
CHANGE TO:

	670-1625-06	CKT BOARD ASSY:--VERTICAL INTERFACE
Q4652	151-0302-00	TRANSISTOR:SILICON,NPN,2N3565
R4615	321-0119-00	RES.,FXD,FILM:169 OHM,1%,0.125W
R4616	321-0119-00	RES.,FXD,FILM:169 OHM,1%,0.125W

ADD:

C4615	281-0615-00	CAP.,FXD,CER DI:3.9 ±0.5PF,200V
R4617	321-0048-00	RES.,FXD,FILM:30.9 OHM,1%,0.125W
R4618	321-0048-00	RES.,FXD,FILM:30.9 OHM,1%,0.125W
R4619	311-1259-00	RES.,VAR,NONWIR:100 OHM,10%,0.50W
R4622	317-0560-00	RES.,FXD,CMPSN:56 OHM,5%,0.125W
R4669	317-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.125W

DIAGRAM - VERTICAL AMPLIFIER - Partial



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MANUAL CHANGE INFORMATION

PRODUCT R7912
070-1590-00

CHANGE REFERENCE M30,392

DATE 9-15-76

CHANGE:	DESCRIPTION

EFF SN B210860-up

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

CHANGE TO:

C1701	281-0096-00	CAP.,VAR,CER DI:5.5-18PF

C1701 is shown on diagram 18 Z AXIS & HIGH VOLTAGE.

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MANUAL CHANGE INFORMATION

PRODUCT R7912
070-1590-00

CHANGE REFERENCE M30613
DATE 11-10-76

CHANGE:	DESCRIPTION

EFF SN B230901-up

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGE

CHANGE TO:

A38	670-2825-01	CKT BOARD ASSY:ELECTRONIC GRATICULE

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MANUAL CHANGE INFORMATION

PRODUCT R7912 Service
070-1590-00

CHANGE REFERENCE C1/1176
DATE 11-15-76

CHANGE:	DESCRIPTION

TEXT CORRECTION

Page 6-103 60. Writing Rate Check

CHANGE: Parts a. and b. to read:

a. Connect a pulse generator (PG 502 or equivalent) to the R7912 amplifier plug-in (7A19 or equivalent). Set the pulse generator for about a 4-volt pulse amplitude and a risetime $\leq$ 1 nanosecond.

b. Set the pulse generator and R7912 amplitude controls to provide a displayed pulse height of eight divisions. Adjust the horizontal position and trigger level controls to view the rising edge of the pulse.

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MANUAL CHANGE INFORMATION

PRODUCT R7912 Service 070-1590-00

CHANGE REFERENCE M30424 &

DATE 12-20-76 M30425

CHANGE:	DESCRIPTION

EFF SN B240906 (M30424)

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

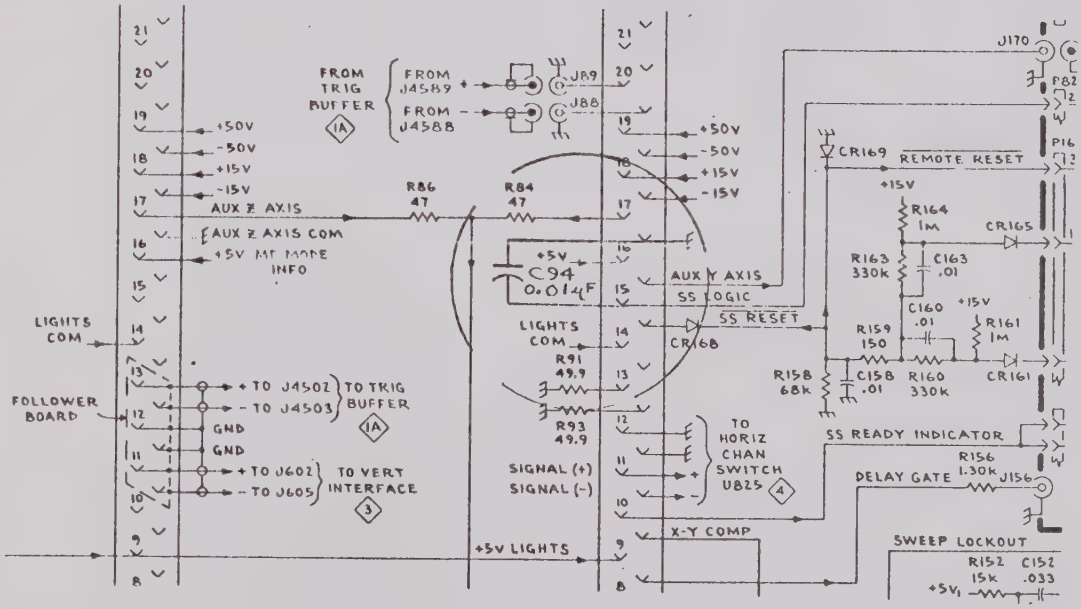
CHANGE TO:

A1	670-2484-02	CKT BOARD ASSY:MAIN INTERFACE

ADD:

C94	283-0002-00	CAP.,FXD,CER DI:0.01UF,500V

DIAGRAM 1 MAIN INTERFACE



EFF SN B240906 (M30425)

CHANGE TO:

C210	283-0680-00	CAP.,FXD,MICA D:330PF,1%,500V

C210 is located on the CALIBRATOR circuit board and shown on diagram 2 FRONT PANEL.

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MANUAL CHANGE INFORMATION

PRODUCT R7912 Service
070-1590-00

CHANGE REFERENCE M30106
DATE 12-16-76

CHANGE:	DESCRIPTION

EFF SN B210857-up

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

CHANGE TO:

A20	670-2480-03	CKT BOARD ASSY:MEMORY

The new Digital Memory circuit board consists of the following:

C1	283-0238-00	CAP.,FXD,CER DI:0.01UF,10%,50V
C2	281-0580-00	CAP.,FXD,CER DI:470PF,10%,500V
C3	281-0536-00	CAP.,FXD,CER DI:1000PF,500V
C4	283-0599-00	CAP.,FXD,MICA DI:98PF,5%,500V
C5	283-0599-00	CAP.,FXD,MICA DI:98PF,5%,500V
C6	281-0621-00	CAP.,FXD,CER DI:12PF,1%,500V
C7	281-0772-00	CAP.,FXD,CER DI:4700PF,100V
C8	283-0649-00	CAP.,FXD,MICA D:105PF,1%,300V
C9	290-0708-00	CAP.,FXD,ELCTLT:820UF,20%,6V
C10	290-0201-00	CAP.,FXD,ELCTLT:100UF,15V
C11	290-0201-00	CAP.,FXD,ELCTLT:100UF,15V
C12	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C13	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C14	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C15	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C16	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C17	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C18	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C19	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C20	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V

CHANGE:		DESCRIPTION
ADD:		
C21	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C22	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C23	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C24	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C25	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C26	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C27	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C28	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
C29	283-0203-00	CAP.,FXD,CER DI:0.47UF,20%,50V
Q1	151-0190-00	TRANSISTOR:SILICON,NPN,TE23652
R1	315-0153-00	RES.,FXD,CMPSN:15K OHM,5%,0.25W
R2	315-0302-00	RES.,FXD,CMPSN:3K OHM,5%,0.25W
R3	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
R4	315-0302-00	RES.,FXD,CMPSN:3K OHM,5%,0.25W
R5	315-0152-00	RES.,FXD,CMPSN:1.5K OHM,5%,0.25W
R6	315-0222-00	RES.,FXD,CMPSN:2.2K OHM,5%,0.25W
R7	315-0682-00	RES.,FXD,CMPSN:6.8K OHM,5%,0.25W
R8	315-0303-00	RES.,FXD,CMPSN:30K OHM,5%,0.25W
R9	315-0302-00	RES.,FXD,CMPSN:3K OHM,5%,0.25W
R10	315-0243-00	RES.,FXD,CMPSN:24K OHM,5%,0.25W
R11	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
R12	315-0302-00	RES.,FXD,CMPSN:3K OHM,5%,0.25W
R13	315-0390-00	RES.,FXD,CMPSN:39 OHM,5%,0.25W
R14	321-0247-00	RES.,FXD,FILM:3.65K OHM,1%,0.125W
R15	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W

CHANGE:		DESCRIPTION
ADD:		
R16	315-0182-00	RES.,FXD,CMPSN:1.8K OHM,5%,0.25W
R17	315-0302-00	RES.,FXD,CMPSN:3K OHM,5%,0.25W
R18	315-0302-00	RES.,FXD,CMPSN:3K OHM,5%,0.25W
R19	311-1228-00	RES.,VAR,NONWIR:10K OHM,20%,0.50W
R20	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
U1	156-0145-00	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR,SN7438N
U2	156-0145-00	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR,SN7438N
U3	156-0145-00	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR,SN7438N
U4	156-0250-00	MICROCIRCUIT,DI:10-BIT BUFFER REG,SN8202N
U5	156-0123-00	MICROCIRCUIT,LI:4-BIT MAGNITUDE COMPARATOR,SN7485N
U6	156-0123-00	MICROCIRCUIT,LI:4-BIT MAGNITUDE COMPARATOR,SN7485N
U7	156-0617-00	MICROCIRCUIT,DI:DUAL 4-BIT BINARY COUNTER,74393
U8	156-0047-00	MICROCIRCUIT,DI:3-INPUT NAND GATE,SN7410N
U9	156-0030-00	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE,SN7400N
U10	156-0030-00	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE,SN7400N
U11	156-0862-00	MICROCIRCUIT,DI:4096-BIT DYNAMIC RANDOM,MCM6604
U12	156-0862-00	MICROCIRCUIT,DI:4096-BIT DYNAMIC RANDOM,MCM6604
U13	156-0862-00	MICROCIRCUIT,DI:4096-BIT DYNAMIC RANDOM,MCM6604
U14	156-0862-00	MICROCIRCUIT,DI:4096-BIT DYNAMIC RANDOM,MCM6604
U15	156-0862-00	MICROCIRCUIT,DI:4096-BIT DYNAMIC RANDOM,MCM6604
U16	156-0535-00	MICROCIRCUIT,DI:TRI-STATE HEX BUFFER,8097
U17	156-0617-00	MICROCIRCUIT,DI:DUAL 4-BIT BINARY COUNTER,74393
U18	156-0123-00	MICROCIRCUIT,LI:4-BIT MAGNITUDE COMPARATOR,SN7485N
U19	156-0032-00	MICROCIRCUIT,DI:4-BIT BINARY COUNTER,SN7493AN
U20	156-0706-00	MICROCIRCUIT,DI:DUAL MONOSTABLE MV,74221
U21	156-0058-00	MICROCIRCUIT,DI:HEX INVERTER,SN7404N

CHANGE:	DESCRIPTION

ADD:

U22	156-0706-00	MICROCIRCUIT,DI:DUAL MONOSTABLE,MV,74221
J23	156-0862-00	MICROCIRCUIT,DI:4096-BIT DYNAMIC RANDOM,MCM6604
U24	156-0862-00	MICROCIRCUIT,DI:4096-BIT DYNAMIC RANDOM,MCM6604
U25	156-0862-00	MICROCIRCUIT,DI:4096-BIT DYNAMIC RANDOM,MCM6604
U26	156-0862-00	MICROCIRCUIT,DI:4096-BIT DYNAMIC RANDOM,MCM6604
U27	156-0862-00	MICROCIRCUIT,DI:4096-BIT DYNAMIC RANDOM,MCM6604
U28	156-0535-00	MICROCIRCUIT,DI:TRI-STATE HEX BUFFER,8097
U29	156-0617-00	MICROCIRCUIT,DI:DUAL 4-BIT BINARY COUNTER,74393
U30	156-0041-00	MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP,DM7474N
U31	156-0047-00	MICROCIRCUIT,DI:3-INPUT NAND GATE,SN7410N
U32	156-0694-00	MICROCIRCUIT,DI:DECODER DEMULTIPLEXER,74S138
U33	156-0089-00	MICROCIRCUIT,DI:4-BIT UP/DOWN COUNTER,SN74193
U34	156-0030-00	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE,SN7400N
U35	156-0058-00	MICROCIRCUIT,DI:HEX INVERTER,SN7404N
U36	156-0058-00	MICROCIRCUIT,DI:HEX INVERTER,SN7404N
U37	156-0706-00	MICROCIRCUIT,DI:DUAL MONOSTABLE, MV,74221
U38	156-0041-00	MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP,DM7474N
U39	156-0030-00	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE,SN7400N
U40	156-0535-00	MICROCIRCUIT,DI:TRI-STATE HEX BUFFER,8097
U41	156-0617-00	MICROCIRCUIT,DI:DUAL 4-BIT BINARY COUNTER,74393
U42	156-0041-00	MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP,DM7474N
U43	156-0171-00	MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE,SN7432N
U44	156-0129-00	MICROCIRCUIT,DI:QUAD 2-INPUT & GATE,SN7408N
U45	156-0861-00	MICROCIRCUIT,DI:VOLTAGE CONTROL OSCILL,74LS124N
U46	156-0030-00	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE,SN7400N
U47	156-0285-00	MICROCIRCUIT,DI:VOLT REG, 12V,1A,7812

CHANGE:	DESCRIPTION

ADD:

VR1	152-0395-00	SEMICOND DEVICE:ZENER,0.4W,4.3V,5%
VR2	152-0195-00	SEMICOND DEVICE:ZENER,0.4W,5.1V,5%

TEXT CHANGES

ADD: Page 6-99a MEMORY

MEMORY

EQUIPMENT REQUIRED

Test Oscilloscope

Dual Trace Amplifiers (2)

Equipment Set-up

a. Connect Test Oscilloscope left vertical Channel 1 probe to pin 8 $\overline{(RAS)}$ of U30. Set vertical sensitivity for 2 volt/division.

b. Connect Test Oscilloscope left vertical Channel 2 probe to pin 6 $\overline{(CAS)}$ of U30. Set vertical sensitivity for 2 volt/division.

c. Connect Test Oscilloscope right vertical Channel 1 probe to pin 3 (AØ) of U40. Set vertical sensitivity for 2 volt/division.

d. Set the Test Oscilloscope main sweep rate to 100 ns division. Internally trigger the main sweep on the negative slope of the signal at pin 8 of U30.

e. Set the Test Oscilloscope left vertical plug-in to Alternate.

f. ADJUST - $\overline{RAS}$ Pulse Width, R19, so the $\overline{RAS}$, $\overline{CAS}$, and AØ pulses are time-related as noted in Fig. 6-30A. The two AØ pulse level changes should align approximately halfway between the start of the $\overline{RAS}$ falling edge and the start of the CAS falling edge of the waveform.

CHANGE:	DESCRIPTION

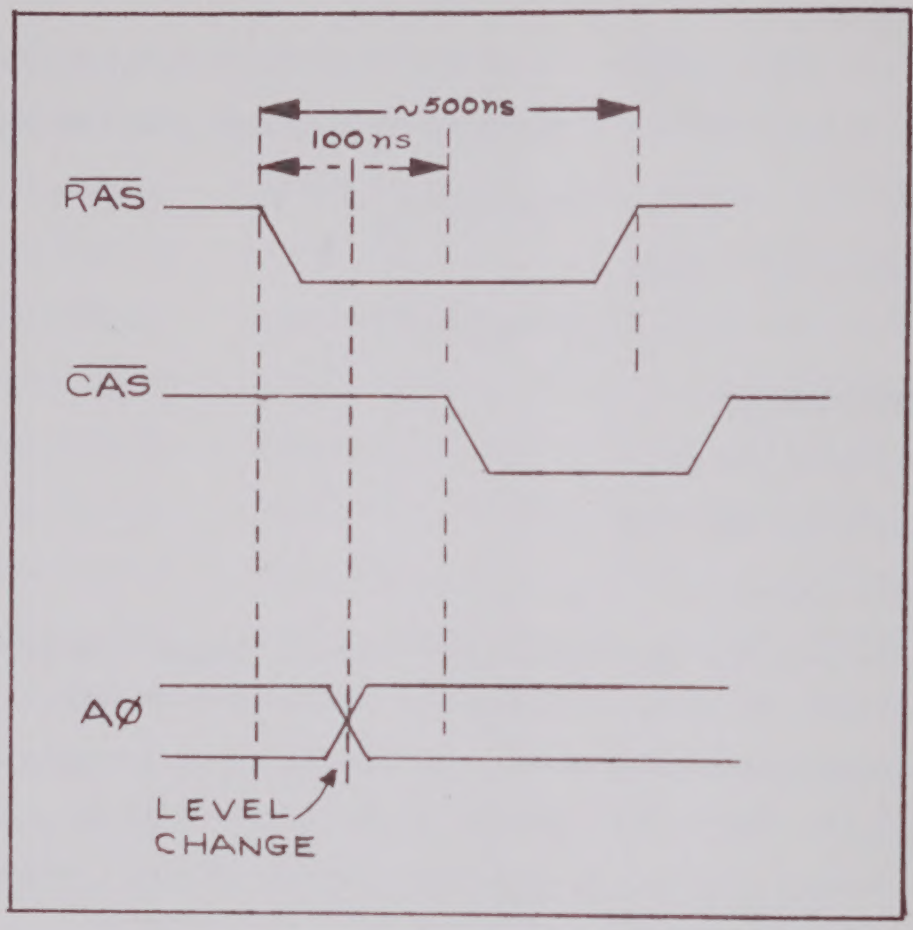
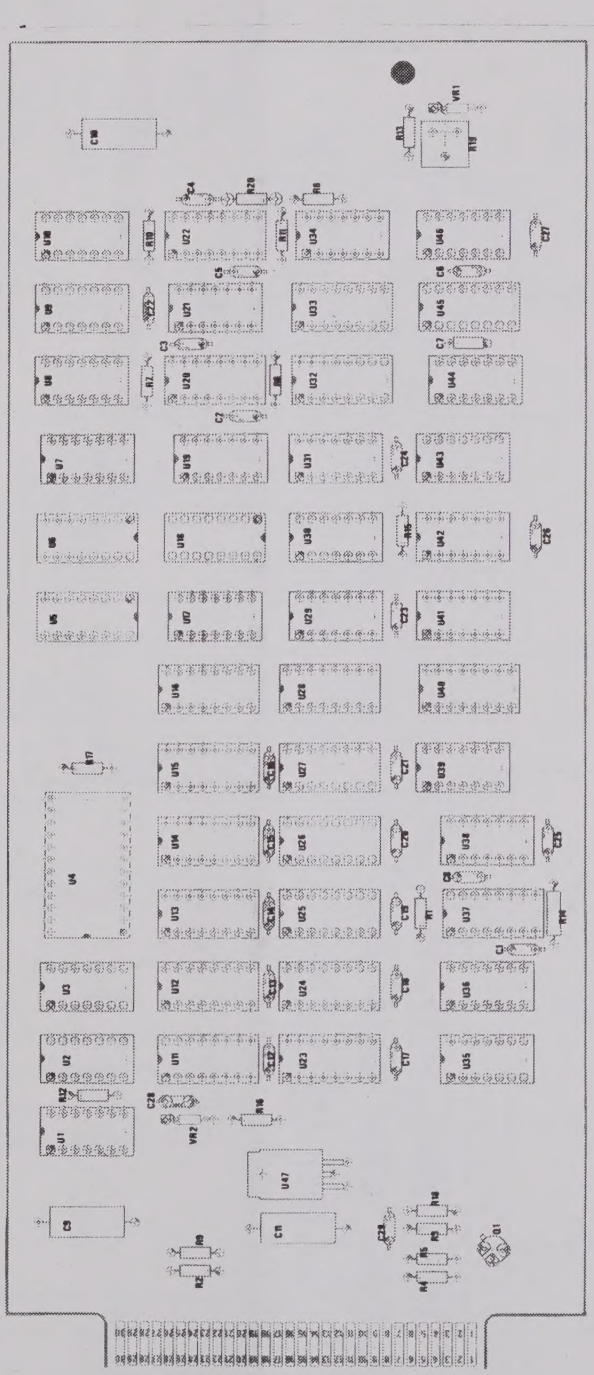


Fig. 6-30A. $\overline{RAS}$ Pulse Width relationships.

With no External Read or Write commands present (Memory Display Unit not connected), the repetition rate period between $\overline{RAS}$ pulses is approximately 30 µs, with 25 µs typical.

CHANGE:	DESCRIPTION

ADD: 670-2480-03 DIGITAL MEMORY CIRCUIT BOARD.



A20—Digital Memory circuit board.